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EDITED BY THURSTON SCOTT WELTON, M.D.

March 1945

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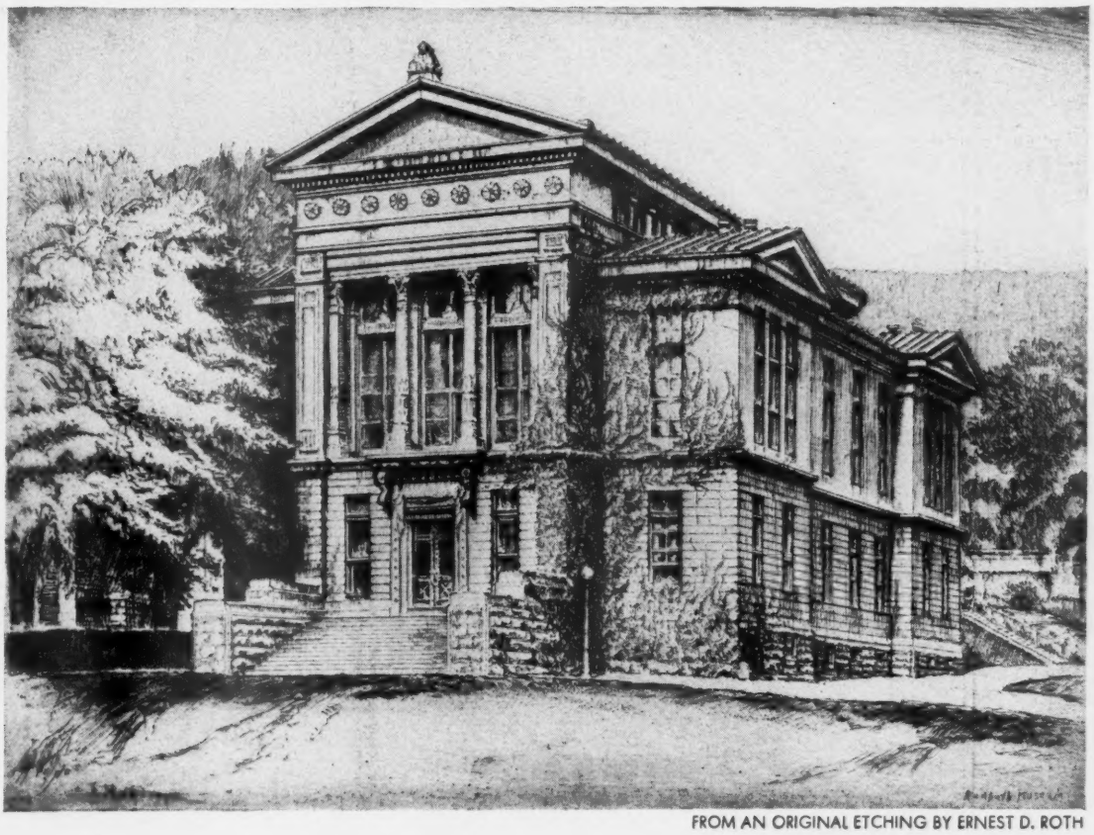

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AN IMPORTANT ADVANCE IN THE TECHNIC OF SUTURING

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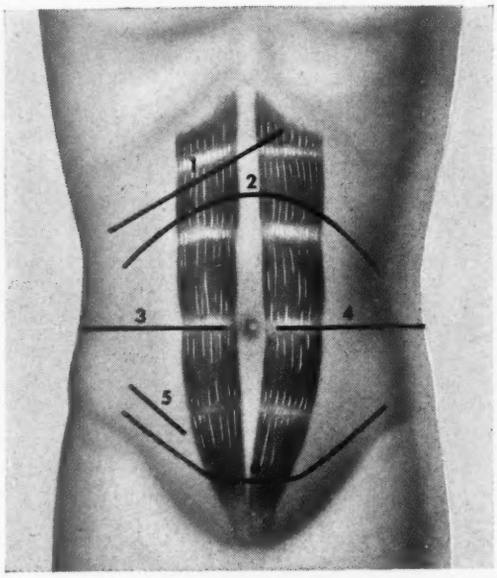

1. For gall bladder, common duct, head of pancreas.
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4. Descending colon, spleen and left sided lesions.
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Sutures hold most securely if the connective tissues within the wound are approximated in such a manner that the sutures must pull against the fibres within these layers. This necessitates cutting the connective tissues parallel to the direction of their fibres which, in the anterior abdominal wall, is usually best accomplished through a transverse initial skin incision.

In the past, transverse abdominal incisions have not found wide acceptance because they necessitate cutting across muscles in which sutures hold poorly and almost invariably cause tissue necrosis.

In the new technic of suturing transverse incisions, no attempt is made to suture muscle—only the surrounding sheath. Approximation of the muscle edges is further aided by keeping the patient in a semi-reclining position with knees partially flexed.

Because of the favorable results attending increasing use of this technic, and the current interest in principles which may facilitate early ambulation, D&G will present a series illustrating the incisions, and methods of suturing them.

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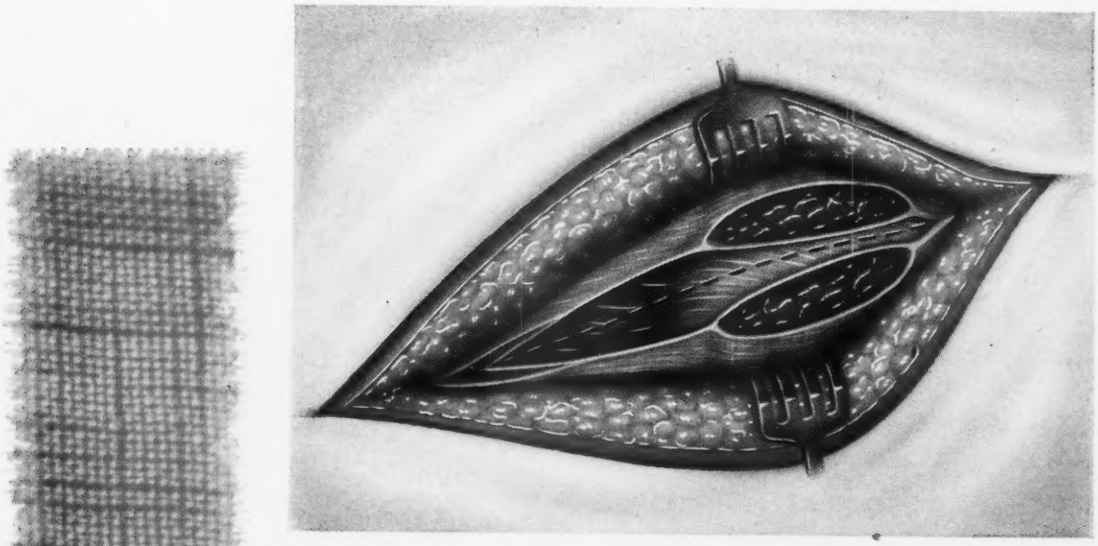

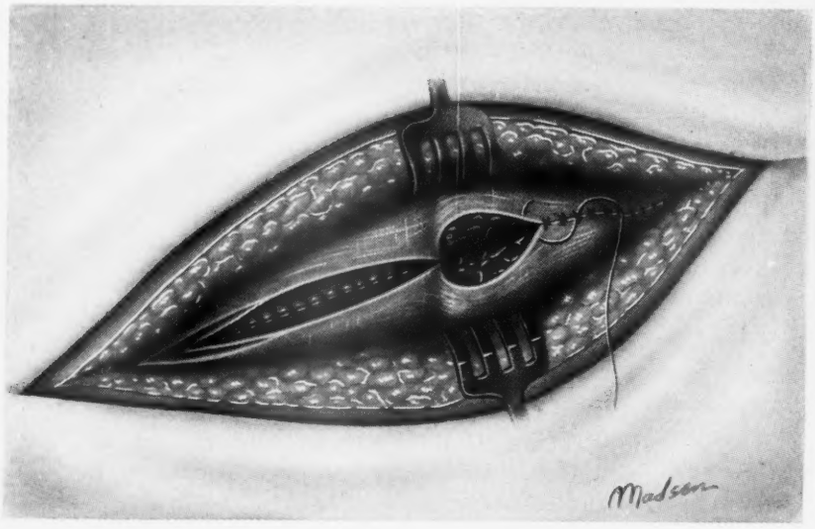

If the costal angle is narrow the incision is made two or three finger breadths below the right costal margin and parallel to it. It is made almost transversely if the angle is wide. The right rectus muscle is cut transversely. The left rectus muscle can also be cut if this exposure is needed. Each muscle contains one or two small arteries and veins of comparable size which require ligation. The lateral muscles are divided parallel to their fibres. The peritoneum and posterior sheath are incised in a direction parallel to their fibres. The falciform ligament is divided in the middle and usually contains a small vessel which requires ligation.

The incision is closed by approximating the falciform ligament first. Next the peritoneum and the posterior sheath are sutured with interrupted sutures. The posterior sheath is sutured separately in the region of the falciform ligament. The muscles are not sutured. The anterior rectus sheath is approximated with interrupted sutures. Size 000 or 00 sutures can be used in both the posterior and anterior sheaths while slightly larger sizes can be used in the linea alba. Very fine sutures, 00000 to 000, may be used in the subcutaneous fat if desired. Drains are placed at the lateral edge of the wound.

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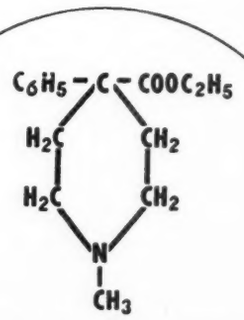

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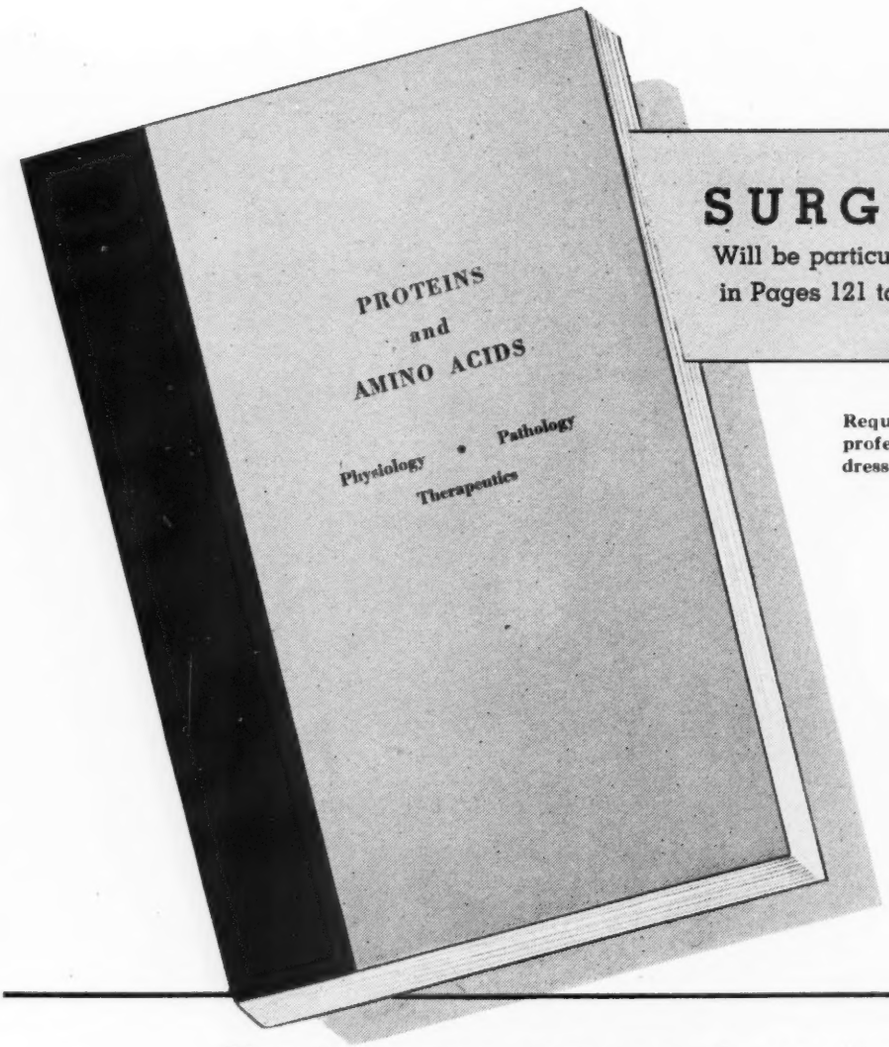

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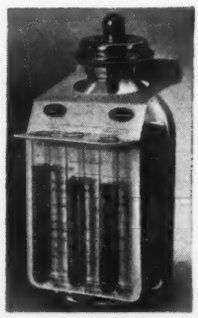

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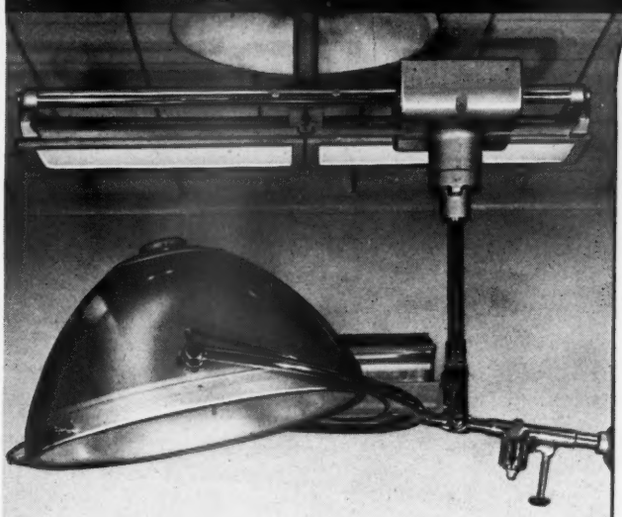

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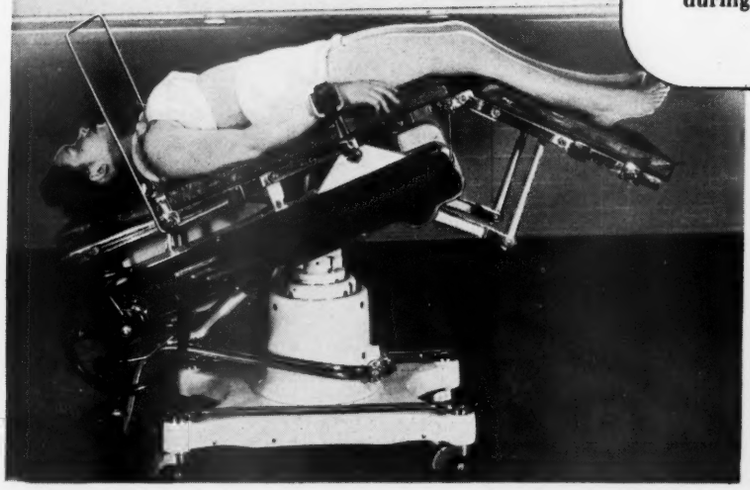

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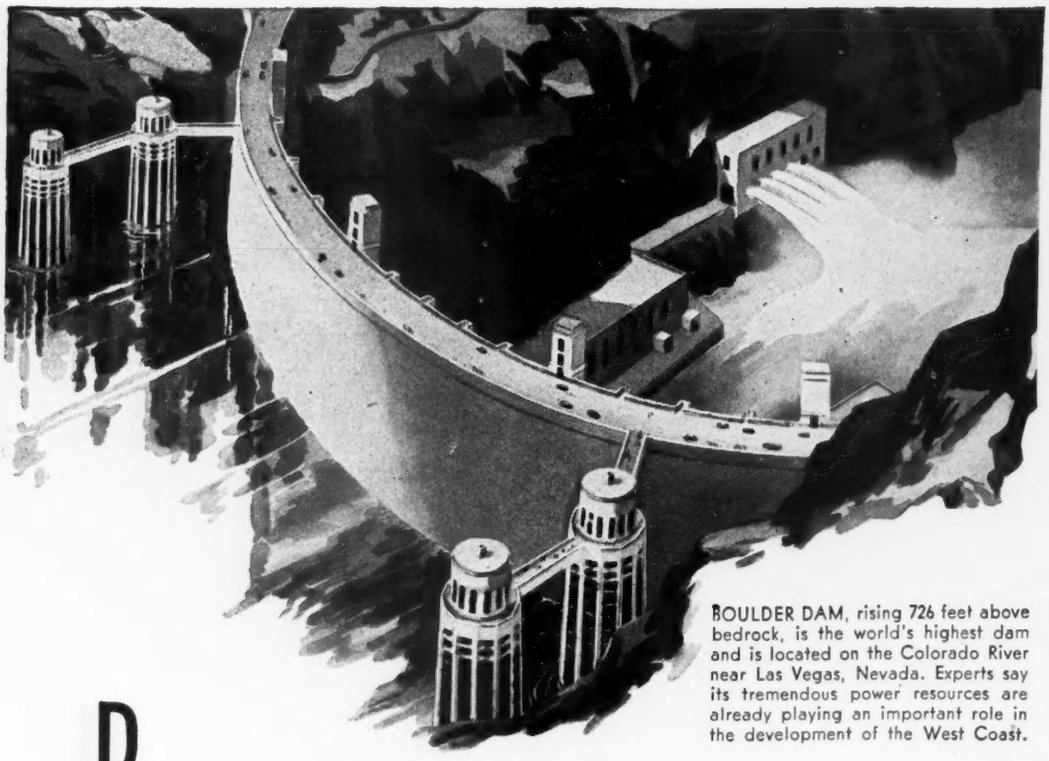

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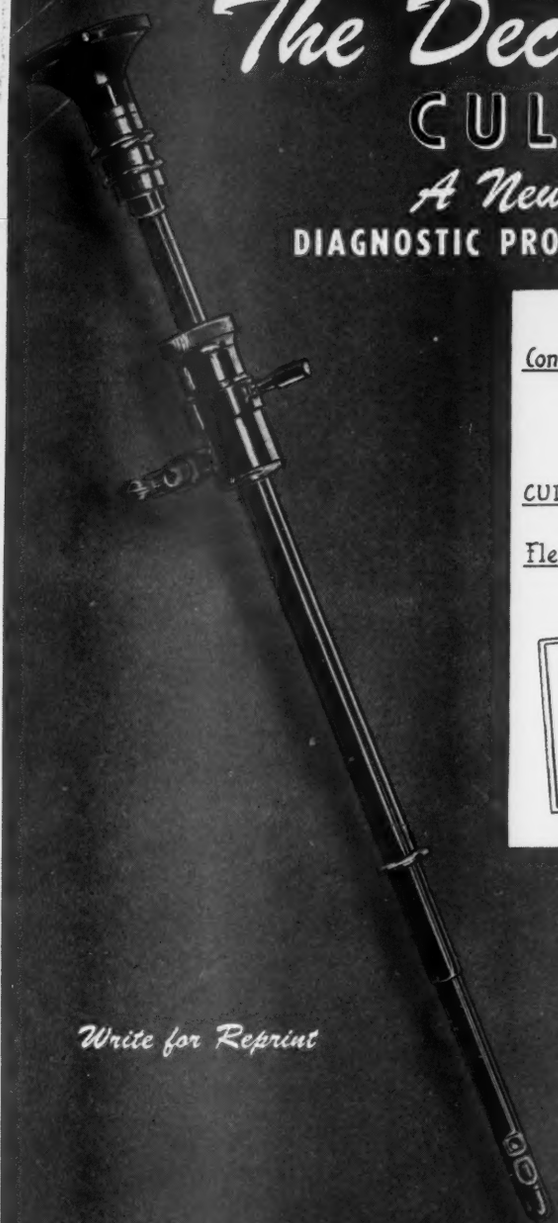

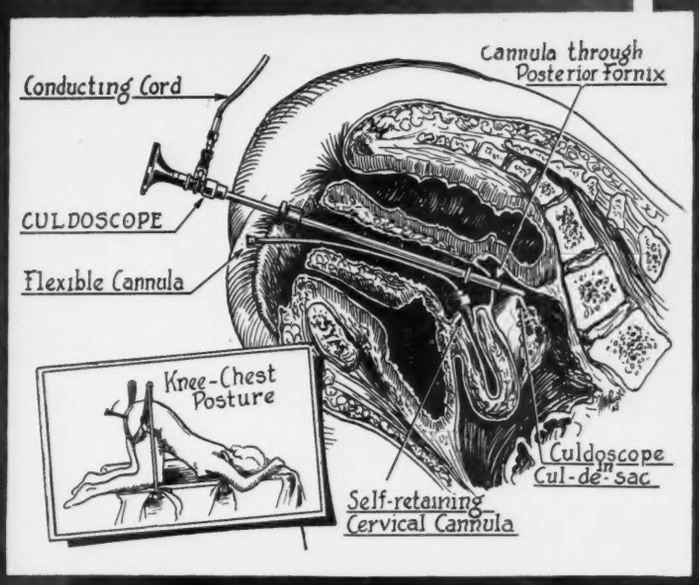

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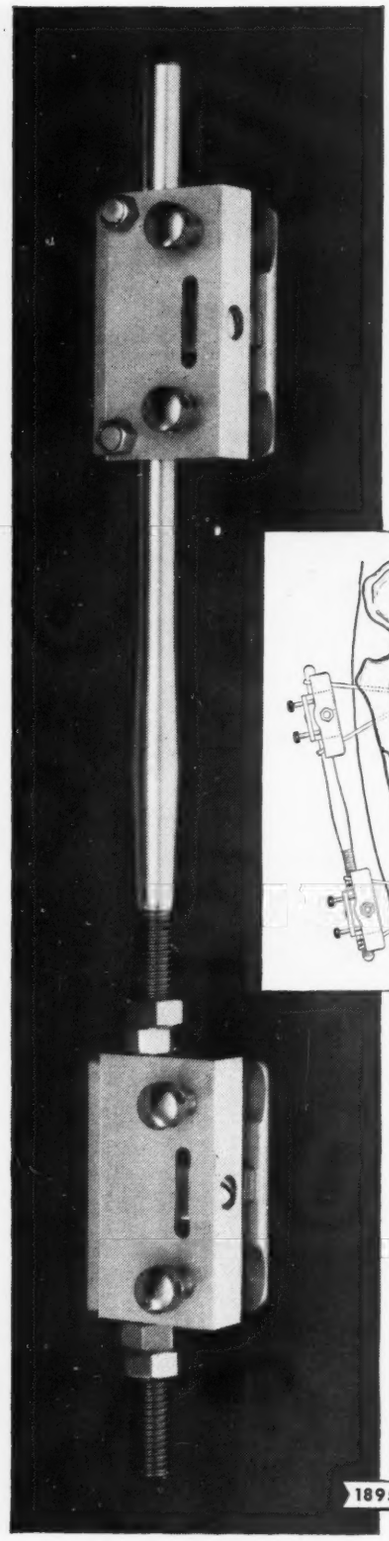

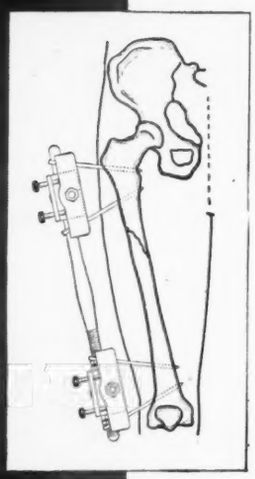

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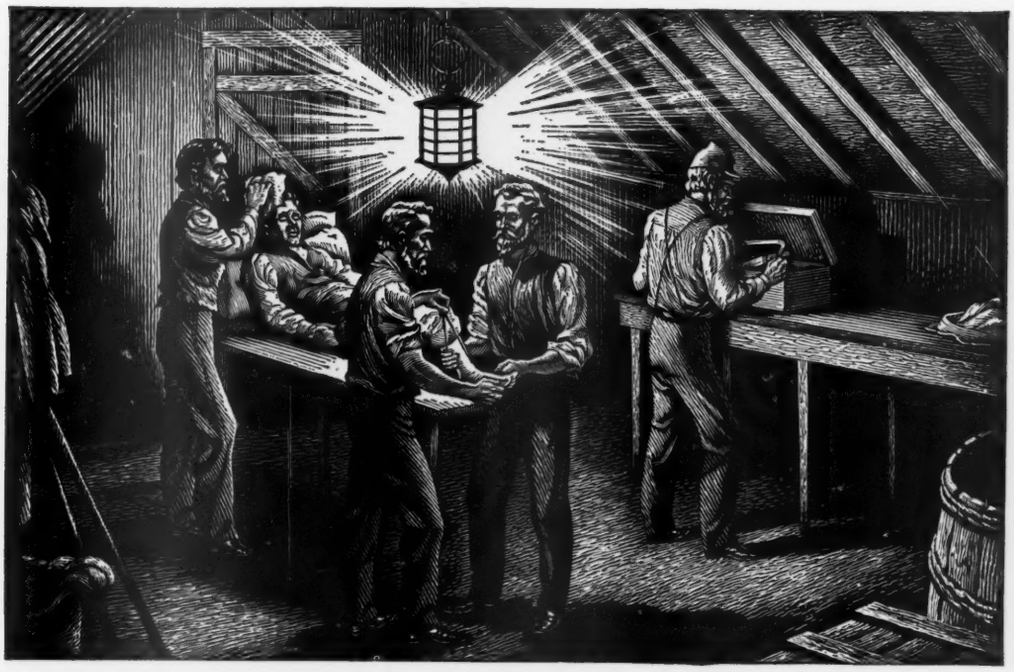

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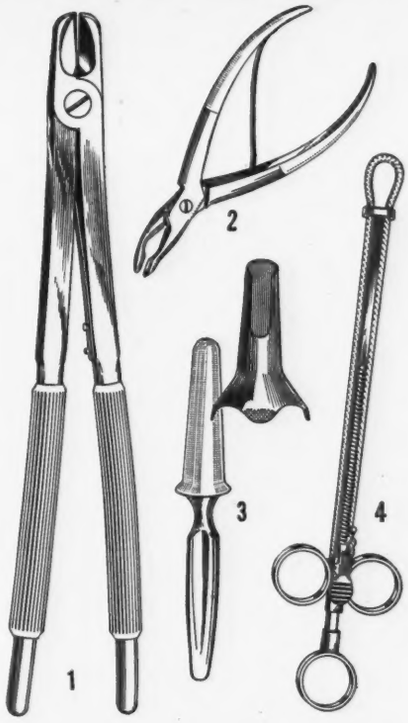

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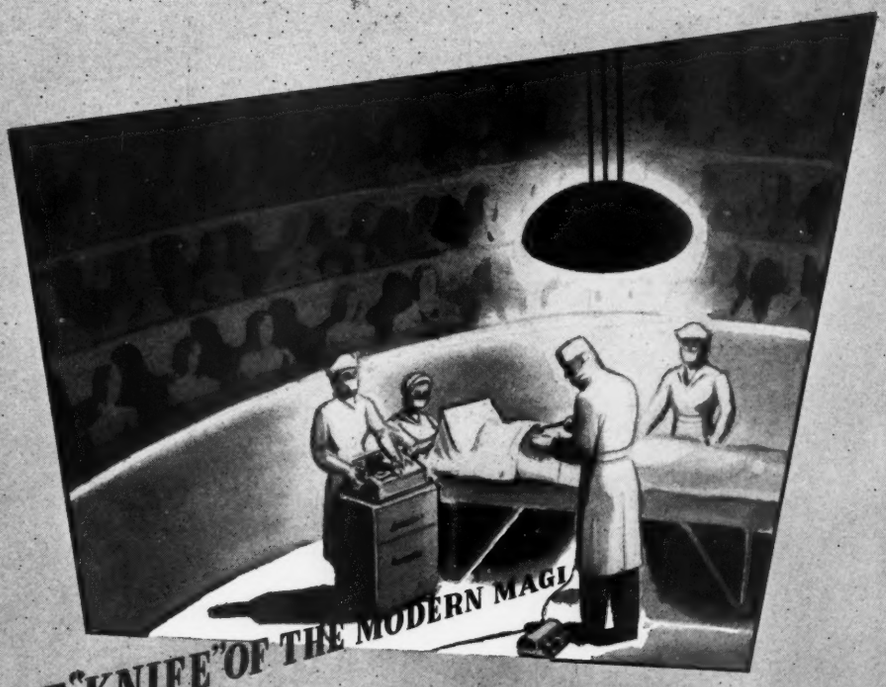

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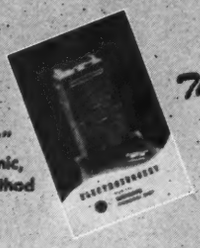

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*Reznikoff, P. and Goebel, W. F.: J. Clin. Investigation 16:547, 1937

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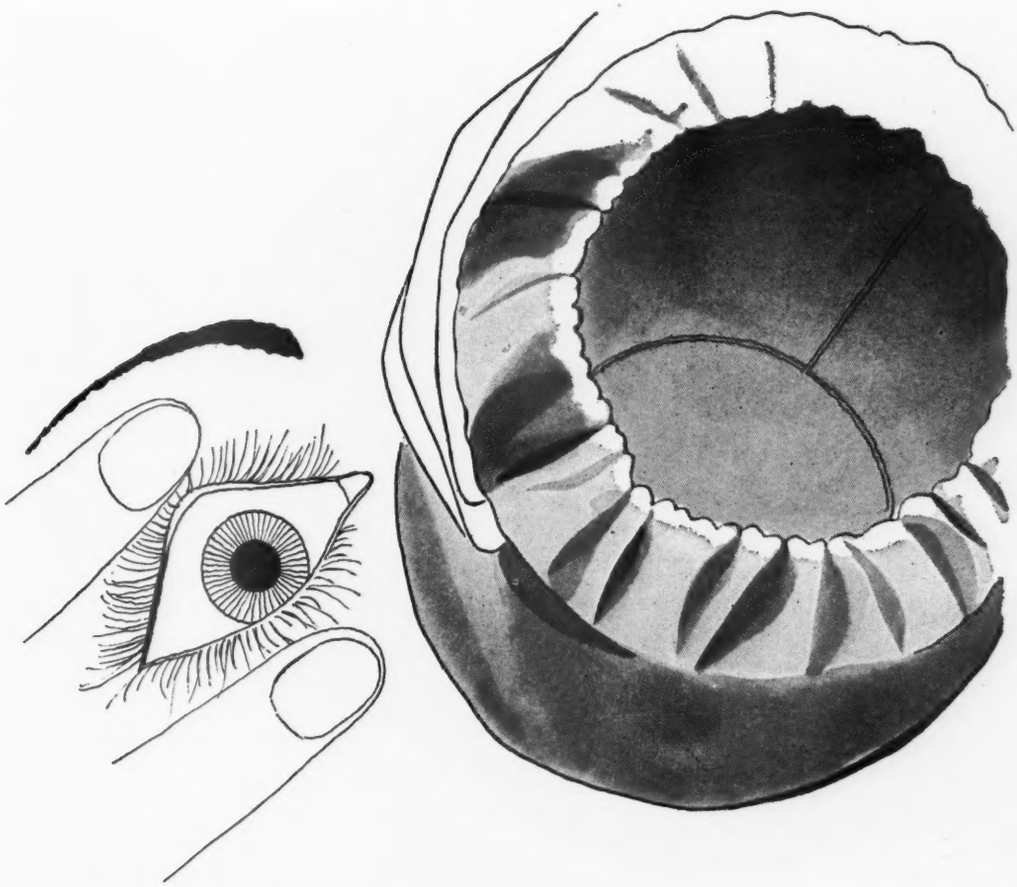

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*Zentgraf, L. P., and Eversole, V. H.: Medical Progress: General Anesthesia: New Eng. J. Med. 229:437 (Sept. 9), 1943.

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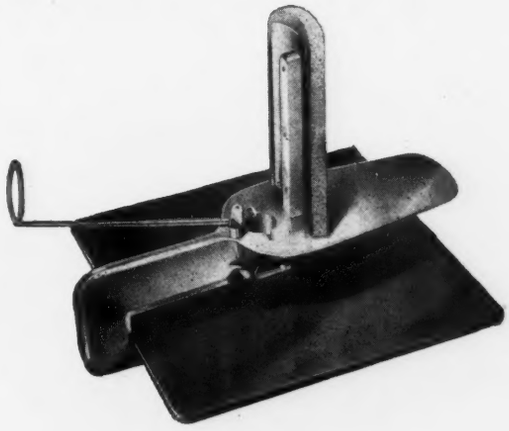

- Excellent for nailing or pinning of intracapsular fractures and intertrochanteric fractures; also adapted to pelvic fractures.

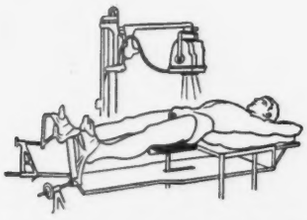

Fig. I — *The anterior tube is centered directly over the fracture.*

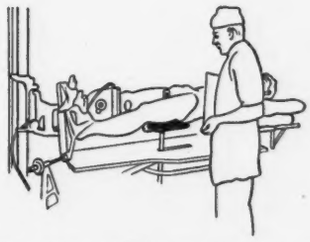

Fig. II—*Tube shifted from anterior to lateral position with center of tube in line with lateral X-ray director without moving either leg or disturbing drapes. For lateral X-ray, cassette is placed in sterile pillow case and held very snugly above crest of the ilium directly opposite the opening of X-ray tube.*

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At thirty, forty is distant middle age.

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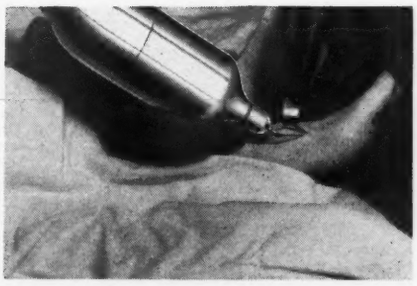
Prominent surgeons and leading hospitals have been finding the Luck Bone Saw a time and labor-saver in this day of overworked medical staffs.

Its high speed makes possible the use of very small diameter slotting burrs. The lower speed, at the opposite end, is ideal for inserting Steinman Pins and Kirschner Wires, as well as for sawing bone and drilling. Variable speed is obtained by foot-controlled rheostat. Complete motor unit and cord can be sterilized in autoclave.

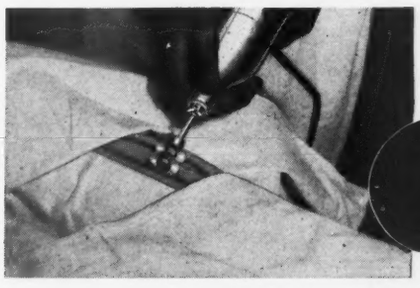


Used with cutting burr in osteoplastic procedures on smaller bones. Here a graft is being cut for fusion of metatarso-cunieform joint. The cutting burr has a multitude of uses.

The Luck Bone Saw is shown here in use with a slotting burr for transverse end cuts during removal of bone grafts. Longitudinal cuts have previously been made with circular saws.

A special shaped burr is used for curreting and saucerizing a chronic osteomyelitic focus. The same burr may be similarly employed in curreting bone cysts or benign giant cell tumors.

The Luck Bone Saw in fitted case with complete equipment.



Used with twin circular saws. They rotate up to approximately 2000 R. P. M. Have great power. Do not jam or burn the bone. Second blade readily removed when only single blade is desired.

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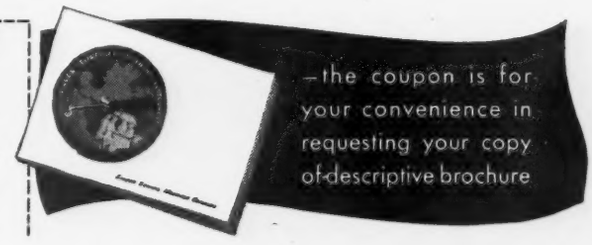

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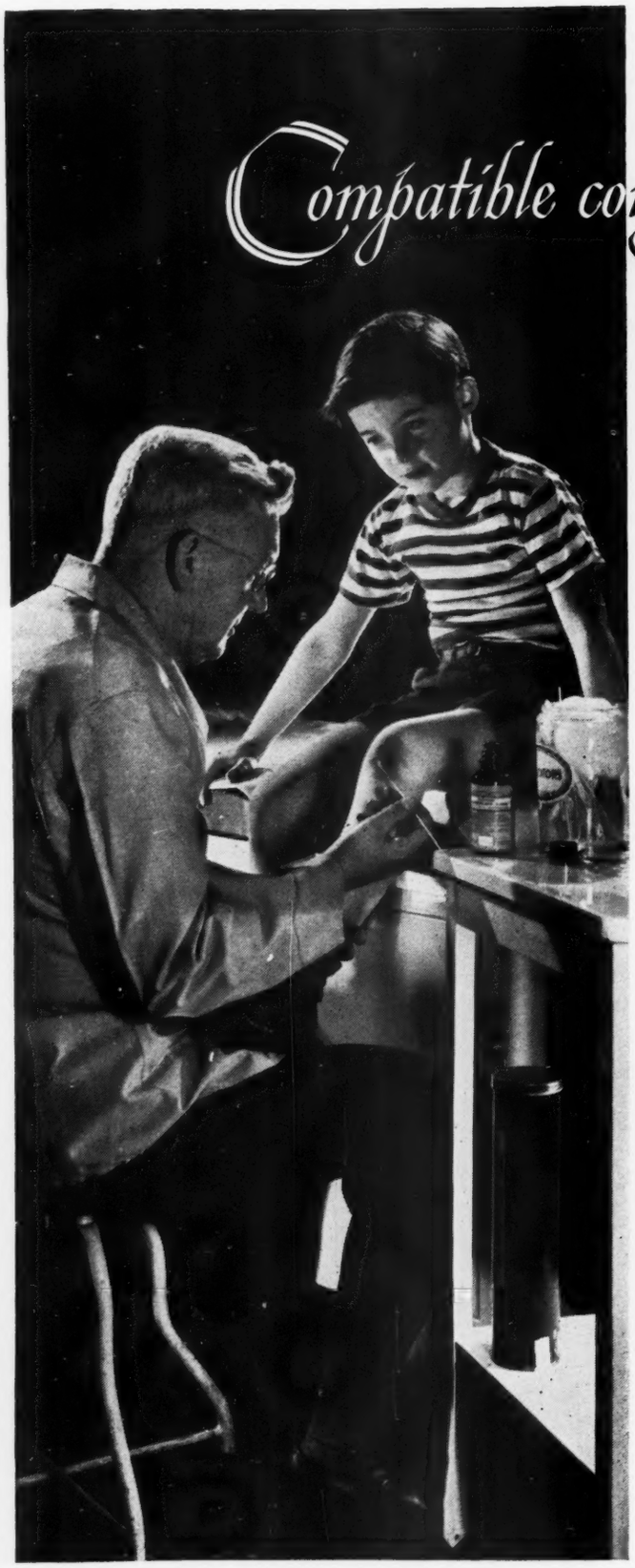

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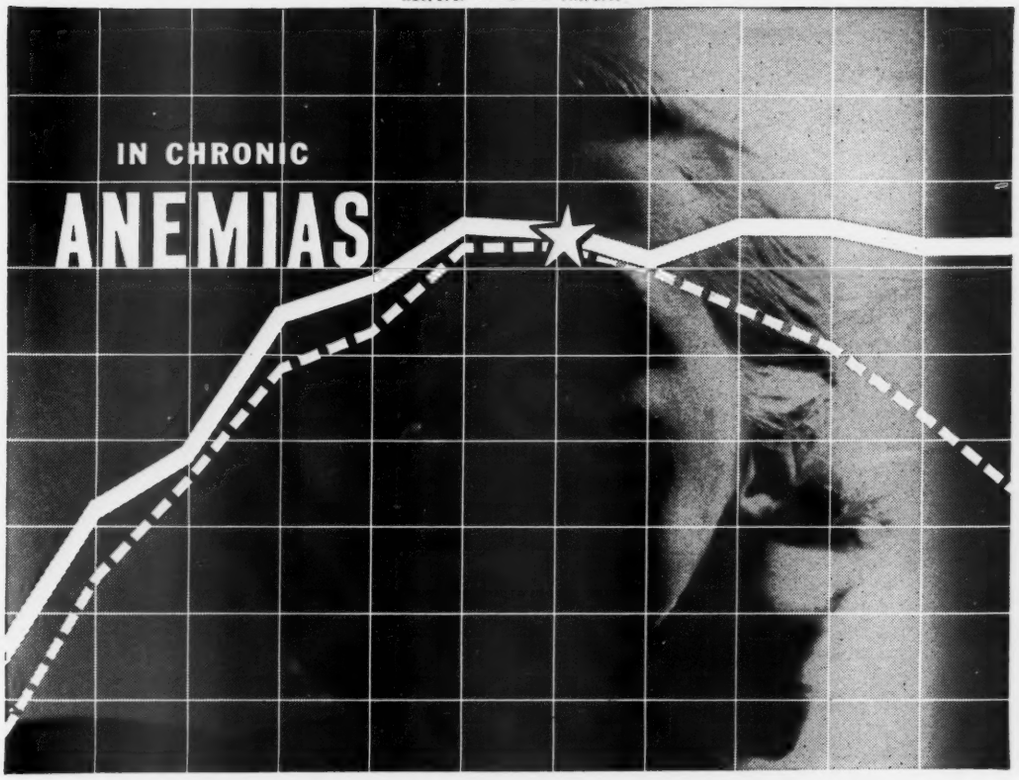

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*Gottlieb, R.: Whole Liver as an Adjuvant to Iron in the Treatment of Hypochromic Anemia, Canad. M.A.J. 47:456-460 (Nov.) 1942.

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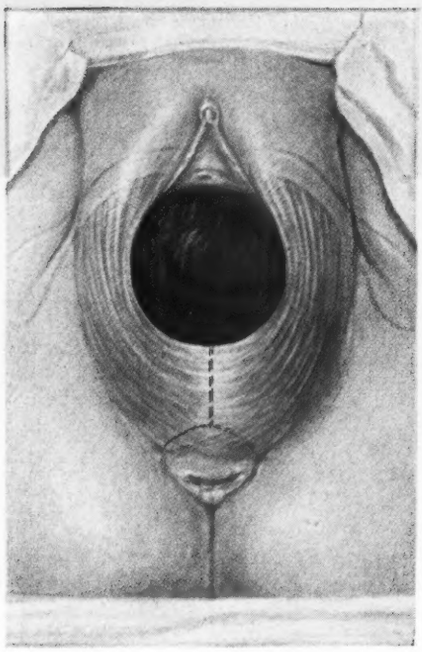
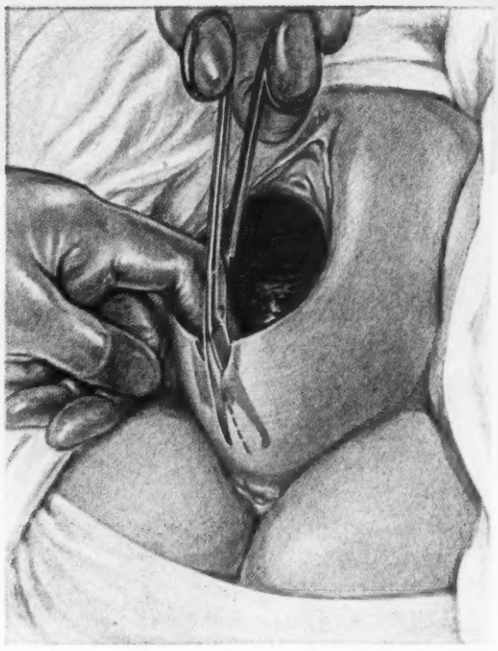
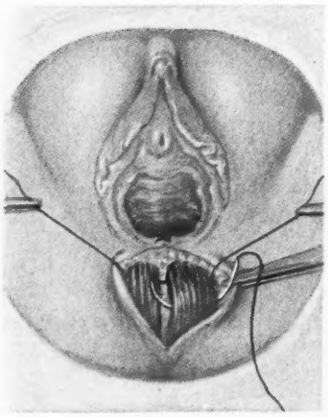


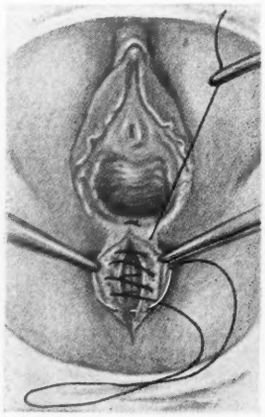
1. Vertical line indicates normal extent of incision. Arc line indicates elective extension, avoiding anal sphincters.



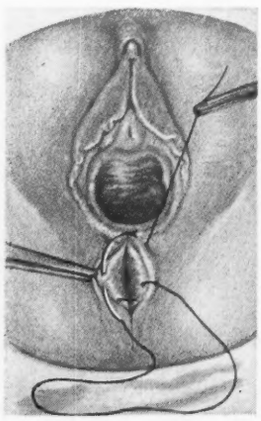
2. Incision is made in avascular midline area, separating the levator ani muscles. Tip-guard scissors used to avoid fetal trauma.



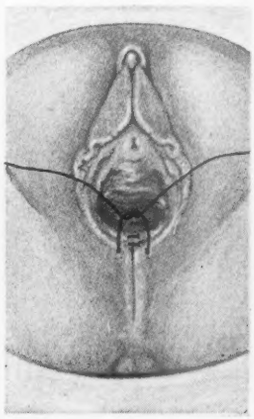
3. Vaginal mucous membrane sutured with interrupted chromic 00. Levator ani muscles approximated with interrupted chromic 0.



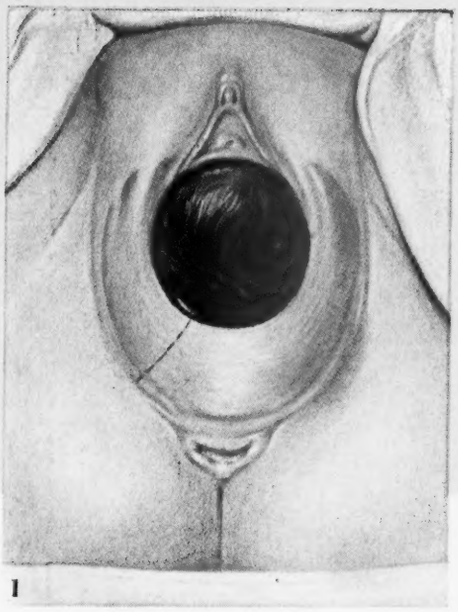
4. Continuous subcutaneous suture, chromic 00, beginning at upper angle and extending full length of incision.



5. Same suture used for subcuticular closure beginning at base of incision and ending opposite primary introduction.



6. Subcutaneous subcuticular repair completed. Note plastic result and absence of irritating external sutures.



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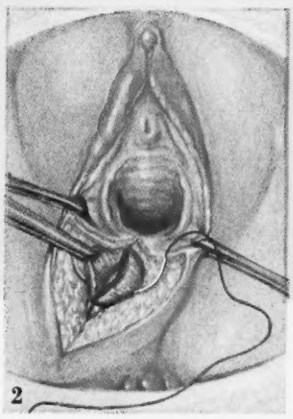

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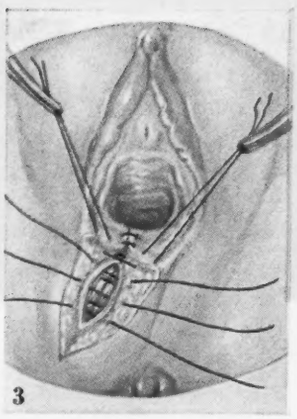


3

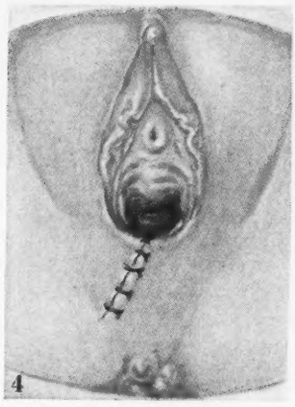
Mediolateral Episiotomy and Repair

1. Dotted line indicates usual extent and direction of incision which avoids possible extension into sphincter area. Incision can be made on either side.

2. Vaginal mucous membrane sutured with interrupted chromic 00. Deep interrupted chromic 0 sutures are used to approximate muscle.

3. Interrupted chromic 00 at mucocutaneous junction held by clamps until subcutaneous sutures are completed.

4. Skin closure completed by interrupted chromic 00. Note all suture ends are cut short to minimize irritation.



4

For Reduced Trauma...Less Tissue Reaction...Faster Healing
Use Ethicon Tru-Chromicized Fine Gauge Catgut Sutures

• The advantages of fine gauge suturing may be achieved with safety by using Ethicon Tru-chromicized, fine gauge catgut sutures. They possess a greater strength-diameter ratio than larger sizes; their gauge uniformity is 6 times greater than U. S. P. requirements; they retain their integrity longer than chromicized sutures of larger gauges.

Exceeding U. S. P. tensile strength requirements (averaging 20% or more on knot pull), Ethicon fine gauge sutures provide a substantial margin of safety against breakage.

ETHICON

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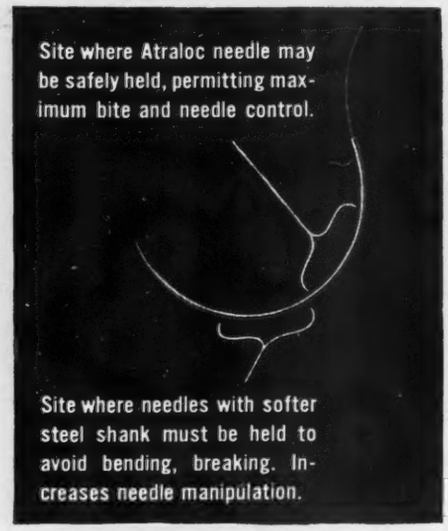
Surgical Gut with Lock-Knot Finish

Needle bending and breaking minimized

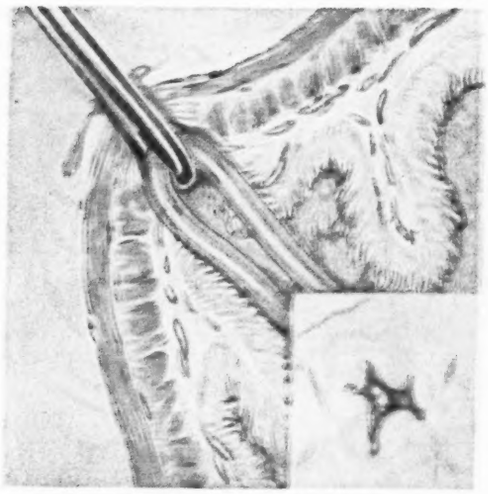
Atraloc Eyeless Needles facilitate surgical skill and dexterity with safety


Site where Atraloc needle may be safely held, permitting maximum bite and needle control.
Site where needles with softer steel shank must be held to avoid bending, breaking. Increases needle manipulation.

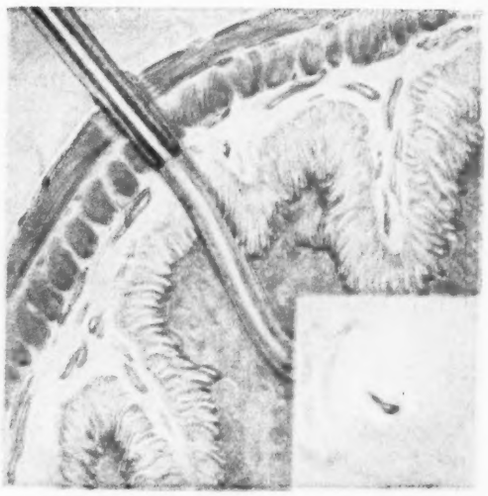
• The more highly tempered steel shank in Atraloc Eyeless Needles gives them greater strength and rigidity in use. A full bite can be taken with confidence when an Atraloc Needle is used to achieve tissue approximation. This greater efficiency eliminates extra manipulations and saves operating time, without increasing breaking hazards.

The shank of the Atraloc Needle is swaged to the suture by a special process. This process permits a relatively high temper just below the shank where strength counts most. Atraloc Needles hold on pulls in excess of U.S.P. tensile strength requirements for sutures pulled over a surgeon's knot.

ATRALOC NEEDLES for minimal suture trauma



EYED NEEDLE: The eyed needle does greater injury to tissue because it pulls a looped suture in its wake.



ATRALOC NEEDLE: The Atraloc Needle causes minimal injury. It pulls a single strand, slightly smaller than the needle.

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Fifty-fourth Year of Continuous Publication

NEW SERIES VOL. LXVII MARCH, 1945 NUMBER THREE

Editorial

PIGEONHOLE IT FOR AWHILE

THIS is written right after New Year's Day, 1945. You will read it sometime in March or April. Perhaps much we have to say will seem distorted, unnecessary, old, or unmentionable by then.

Right at this moment the world is in an awful mess and we seem to be in the center of it. Not long ago the Germans on the Western front made a sudden drive and for awhile gave our boys a terrific pushing around. At this writing the news seems brighter. We have snub-nosed the tip of the salient and are denting the north and south lines. As we go to press the bulge is gone and almost forgotten. But we're holding our breath. Unconsciously we are in a subdued panic of apprehension. Out in the East the reports are rosy. We seem to be doing all right, but those in the know assure us we have a long, long way to go before we are in sight of victory.

Things must be serious. Horse racing in this country is OUT for the duration. "They" say it was a *mistake* that it was not shut down long ago. It is proposed putting the 4 F's on essential war work. About time! "They" say it was a *mistake* to let this class do no essential labor. It seems farcical for a big husk of a man playing professional football not in uniform because he has a hole in an ear drum, or another fleet-footed lad playing shortstop on a National league baseball team because he has an arthritic ankle joint, but neither can tote a gun or work at a lathe. This is not the individual's fault; "they" ordered it done that way. Of course everyone can extend this list ad nauseum. Not long ago "they" stopped training air pilots and diverted them to other channels. Now, we hear, it was a *mistake* and "they'll" train pilots again. Suddenly as of midnight of the first day of the new year, food coupons became so much waste paper. The howl of the housewives will never down—or, at least not for many, many months. "They" said "they made a *mistake.*" Billions of coupons had accumulated and the food was just not there. "Excuse it, please."

Recently orders have gone out to reclassify all lads doing farm work, reshuffle all 4 F's and see that those up to twenty-nine or so get into essential war work; and God help those who left a war job for a civilian job, having in mind post-war security. It was all a *mistake* "they" cry.

We look every noontime at a large group of medical students dressed in army and navy uniforms. They are studying medicine and Uncle Sam's paying their tuition, their expenses connected with this study, and also paying them around $135.00 a month up, depending upon circumstances. We had to have medicos in the armed

forces, hence lower premedical standards. A boy was given two years of college work crammed into eighteen months; then he entered a medical school, and crammed four years' work into three years, and on top of this a nine months' internship. (God help us all!) In this way the government would get about five or six thousand extra physicians every four years. Last spring "they" began to curtail. The number of lads to be in uniform in the future would be noticeable by their lack of personnel. But we sit in dread. Any minute we fear "they" will say it was all a *mistake* and that we MUST have more physicians and so "they" will send us 10,000 boys just eighteen years old who have about completed a high school education—and "hurry it up." An instructor in a Medical School tells of a student who went to the washroom and missed the entire sophomore year.

"They" closed up factories. Now "they" are frantically building factories for goods to be delivered a year from now. "They" acknowledge "they" made a *mistake.*

Meanwhile prepaid insurance plans for medical and surgical care are breaking out like a measles rash throughout the country. "Oh, yes, no sense trying to do anything about it," we hear on every hand; "there's going to be many changes—we're in for Socialized Medicine, and we're going to get it whether we like it or not." So much has been written and said on the subject the average person is in a mental haze. We know the Wagner bill is around the corner, like the wolf ready to spring. We admit, there is room for improvement. We are in a process of evolution. But we hope there will be a pause, that "they" will not pass legislation while 60,000 physicians are in uniform, the majority of them out of the country. It would be a calamity for hasty action now and later on to be informed that "they" made a *mistake;* and it is evident that the best minds at this time make many honest mistakes! There must be more important and pressing problems than this medical issue. It must be more important to get down to business and win the war and then win the peace; and, when this is done, it will be time sanely and soberly to consider the pros and cons of the subject.

So, as you read this we hope the news on all sides is tinted with a rosy hue, that our hearts are a bit lighter, that we listen to radio or read headlines without dreading the news will be bad; and we hope peace is truly in sight, just around the corner. Until and after that time we trust and pray "they" will leave the structure of medicine alone for a little while and not make other needless and unnecessary *mistakes.*

T. S. W.

Original Articles

TWENTY-FIVE YEARS' EXPERIENCE WITH PLASTIC RECONSTRUCTION OF THE BREAST AND TRANSPLANTATION OF THE NIPPLE

MAX THOREK, M.D.
Professor of Surgery, Cook County Graduate School of Medicine
CHICAGO, ILLINOIS

THE method of simple plastic reconstruction operation on the breast with free transplantation of the nipple, which I reported at a medical meeting in Chicago in 1921[1] and recorded in 1922,[2] is, with surgical experience and modern methods of anesthesia, advantageously carried out, bilaterally whenever necessary, at one operation. The results are, as a rule, uniformly satisfactory.[3,4,5,6]

The procedure is not only simple and less tedious for patient and surgeon than any of the long list of surgical methods familiar to us[7] but is also productive of best esthetic results. The simpler procedure, followed with scrupulous care as to exact apposition of surfaces, meticulous hemostasis, avoidance of unnecessary trauma to the tissues, and proper selection of suture material,[8,9] is free from the complications attendant upon the more elaborate and time consuming, multiple stage procedures. In such procedures, the dangers of infection and necrosis and the incidence and degree of scarring and keloid formation are greater than in the simple operation. (Figs. 1 and 2.)

Operative Procedure and Technic. It is important for the patient to be properly anesthetized to obtain successful results in my operation of plastic reconstruction of the breast and free transplantation of the nipple. I have, in recent years, been using intrasternal anesthesia in a large number of my cases with excellent results. Because of the advances in anesthesia and the improved operative technic, I have abandoned operating on each breast at different periods. Both breasts may now be operated upon effectively at the same time. The time of operation should not exceed from an hour and three quarters to about two hours for both breasts.

In my previous technic, I used a solution of brilliant green for tracing the proposed lines of incision. This has been discarded. At no time should the outlines for the proposed line of incision be drawn when the patient is lying down. The patient should be in a semi-sitting position on the operating table. Every patient must be studied thoroughly prior to operation. Previously, I outlined the position of the nipples on the morning of the operation, but I have abandoned this because I found it best to outline the position of the nipples after the breasts have been reshaped and the skin flaps sutured.

The nipple and as much of the areola as is deemed advisable are carefully dissected free. After resection of the breast substance to the desired extent the raw surfaces are closely approximated to eliminate the possibility of leaving any pocket for hematoma formation which may become potential foci for tissue necrosis. The sutures should not be tied too tightly causing the tissues to appear exsanguinated and blanched. Cotton technic, with properly selected needles, is used throughout the operation for hemostasis and skin suturing.[8,9] As a rule no drains are used.

Free Transplantation of the Nipple. A circular area in the desired location on the reconstructed breast is now circumscribed by a sharp pointed scalpel for the reception of the freely dissected nipple and areola. The object is to secure union between the raw surfaces of the nipple transplant with the exposed vascular bed on the remodelled breast surface prepared for its reception. Too deep excision is to be avoided as the implantation of nipple and areola on a purely adipose bed, notably poor in blood supply, may not yield the usual good results. The area of the excised nipple and areola should be slightly larger than that of the receiving bed, since upon removal, the nipple immediately contracts and difficulty in approximating the edges may lead to poor results. Using a fine cutting needle and fine cotton sutures, the surgeon fixes the nipple and areola in proper position with as many sutures as are necessary to obtain proper coaptation without tension. One may use fine chromicized catgut sutures with needles of proper caliber, if one prefers, for suturing the nipples in place.

It is important to explain to the patient that immediately following the operation the nipples will become more or less discolored, but that such discoloration is temporary, without danger to the "taking" of the nipple and that the dark color will gradually but surely disappear. There will be no sloughing of the nipples if the proper technic is used. Soon the most superficial stratum of the skin is cast off. Under the discolored surface the transplanted nipple is healing and will be of pinkish hue as soon as the discolored layer is eliminated. Pigmentation will gradually take place. (Figs. 3, 4 and 5.)

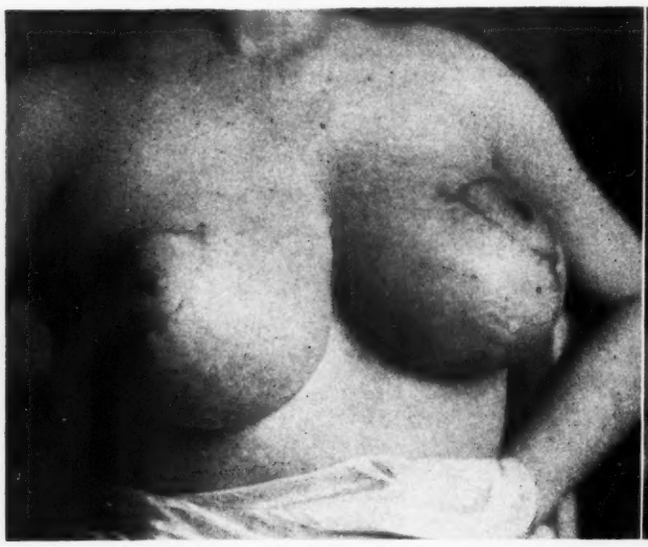


Fig. 1. Undesirable results of multiple stage operations for pendulous breasts. Such cases are to be considered as failures because of unesthetic appearance of the breasts, conspicuous scarring and asymmetry.

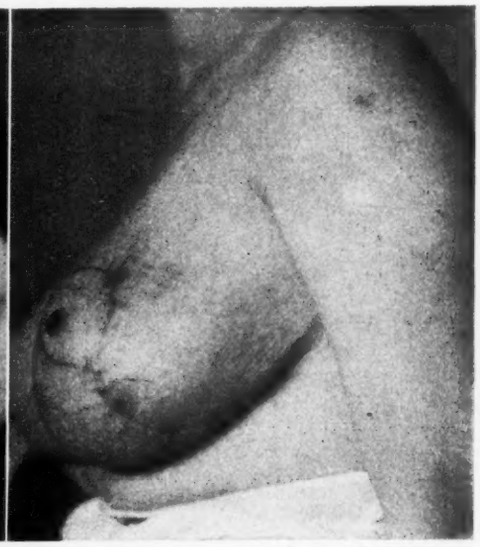


Fig. 2. Same patient as in Figure 1; lateral view.

As recently as September, 1944, Dr. Jacques W. Maliniac contributed an article to the *American Journal of Surgery* in which he states, "it is impossible to transplant the nipple free by now available technics." Many hundreds of successful cases of transplantation of the nipples afford ample proof refuting such a statement. Dr. Maliniac further states that microphotographic illustrations of such grafts point to the presence of skin elements only. This is quite correct. The nipple is nothing more than a highly organized skin structure, and the proof here offered again unreservedly contradicts Dr. Maliniac's statement. He asks for

"microscopic evidence of muscular fibers and ducts obtained from sections of transplanted tissue." Since erection of the nipple depends upon the presence of muscular elements, and since this has been proved unmistakably by myself and others by clinical manifestations, the presence of muscular fibers must be admitted. William Milton Adams[10] states: "The purpose of this article is to give additional proof that free transplantation of the nipples and areolae can be performed." Adams confirms my observations: "There was a definite erection of the nipples on manipulation, which could only result from the contraction of the smooth muscle grafted with the nipple."

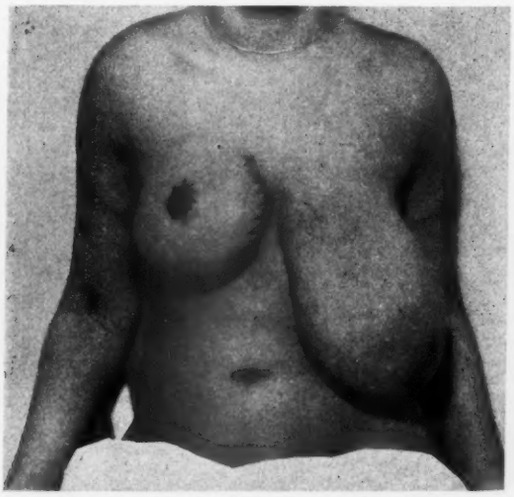


Fig. 3. Colored girl, fifteen years of age; bilateral virginal hypertrophy of the breasts. First stage of author's operation completed. (Author's Service, Cook County Hospital, Chicago, Illinois.)

However, since Maliniac insists on proof of ducts in the microphotographic image, this gives rise to the question: Of what use are ducts in a nipple that is not intended for nursing? Markedly hypertrophic, pendulous breasts have little, if any, lactophorous function. Patients thus afflicted are primarily interested in obtaining relief, from discomfort (subjective and objective) and a satisfactory esthetic result, and not in the nursing of offspring. Nevertheless, we have accepted this challenge and offer below additional indisputable histologic proof of successful taking of transplanted nipples, and the histologic presence of muscular, ductal, nervous, glandular and other normal components of the nipple. (Figs. 6 to 14. See also plate of microphotographs in color showing the various histologic elements of transplanted nipples.*)

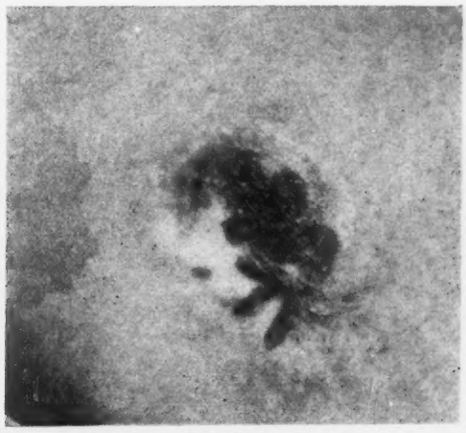


Fig. 4. Two months after transplantation of the nipple in colored girl. (Fig. 3.) Note partial pigmentation of the nipple.

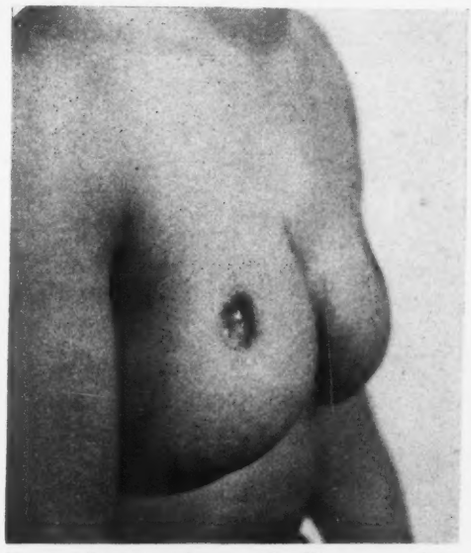


Fig. 5. Same patient as in Figure 3, three months after plastic reconstruction of the breast and nipple transplantation. Note complete pigmentation of nipple.

Dartigues,[11] of Paris, was first to adopt my method and popularize it on the

* I am indebted for the histologic studies of the transplanted nipple tissue to Professors Maurice Oppenheim and Walter Schiller.

European continent. Others have been equally impressed with the advantages of the uncomplicated procedure as compared with the intervening twenty-five years have only added proof upon proof that properly transplanted nipples do unite to subjacent

Fig. 6. Transplantation of nipple three months after operation; Van Gieson stain; low magnification; E, epithelium; N, nerve.

with the frequently mutilating and scarring results of multiple operations.

In this connection may it be stated that Professor Axhausen in 1926,[12] in evaluating the various plastic operations on the breast, questioned the fate of transplanted nipples by my method and said: "*If this important question could be answered in the affirmative, it would then certainly be better to resort to Thorek's operation than to court a possible necrosis of the nipple, should there occur a mishap by reason of a technical error in performing a Lotsch (transposition) operation.*" The recorded successes during

structures. Besides the microscopic proofs I am submitting additional clinical proof that should unreservedly confirm my original contentions. (Figs. 15, 16 and 17.)

An Evaluation of Reconstructive Surgery of the Female Breast. At a time when the art of the surgeon's hand has been devoted with the greatest possible skill to effacing the mutilations wrought by War and congenital malformations, it would seem hardly necessary to discuss the justification for and the evaluation of reconstructive surgery of any part of the human body. If improvement in personal appear-

ance were the sole reason for the plastic surgery under discussion, it would still be justifiable and in the same category with skin plastics and tissue grafts of various kinds used to lessen the embarrassment of the unfortunate bearer of the disfigurement and to minimize the embarrassment and revulsion in those brought in contact with such individual.

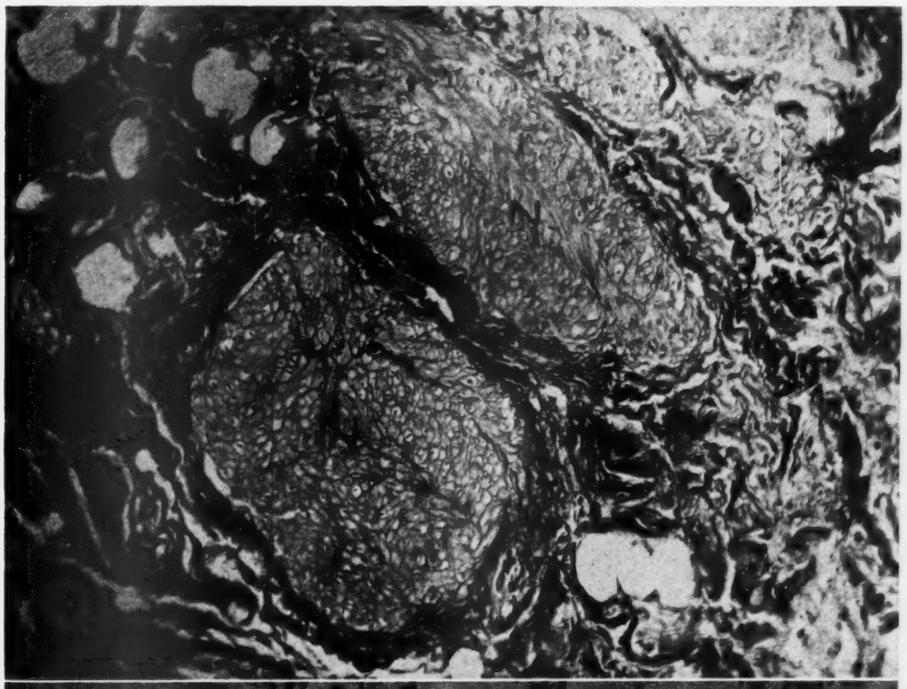


Fig. 7.

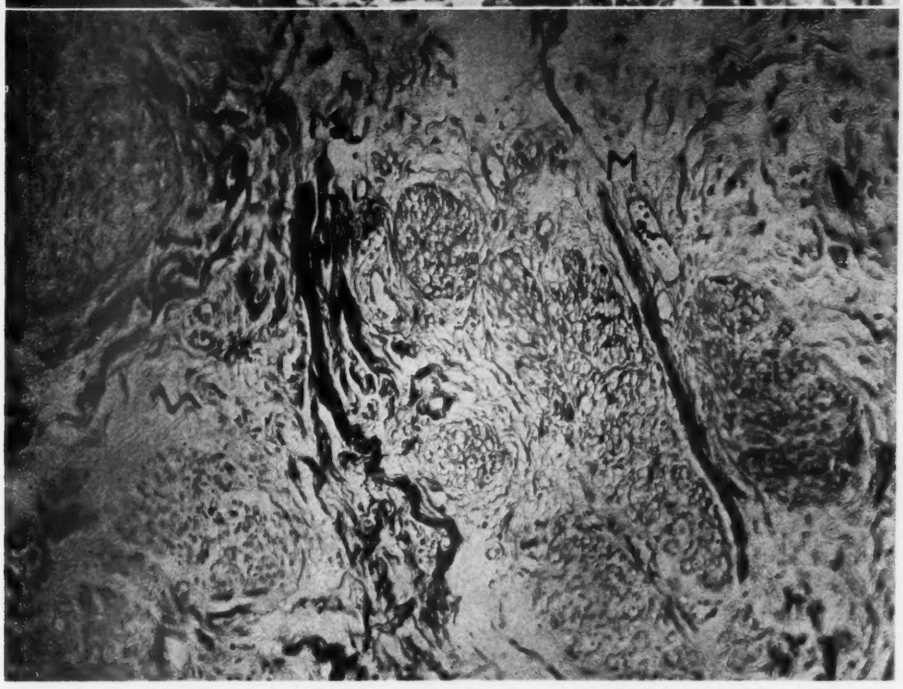


Fig. 8.

Fig. 7. Transplantation of nipple three months after operation; Van Gieson stain; magnification 150 ×; nn, nerves.

Fig. 8. Transplantation of nipple three months after operation; Masson stain; magnification 130 ×; m, muscle fibers in longitudinal section.

Pendulous and enormously hypertrophied breasts may be definitely responsible for much physical and mental suffer-

ings. This is particularly manifested in persons whose occupations bring them in contact with the public (business women, speakers, singers, artists, etc.). They frequently suffer keenly both mentally and physically. Certainly enormous deposits of fat are a deformity and physical handicap which hinder locomotion and exercise. (Figs. 18, 19 and 20.) They represent diseases of an endocrinic, metabolic and other functional origin. The excessive weight frequently causes circulatory disturbances and impeded lymph circulation followed by a chain of complaints of greater or lesser severity, drawing pains, backaches, oppression, tension, intertrigenous eczema, psychic depression and a chain of inferiority complexes. Kyphosis frequently results from an attempt of the patient to equalize the weight produced by the pendulous breasts through constant bending backward. Sometimes ulcerations occur and even tumor formation. Certainly with the removal of such excess tissue, the amount of tissue subject to the possibilities of neoplastic transformation is reduced.

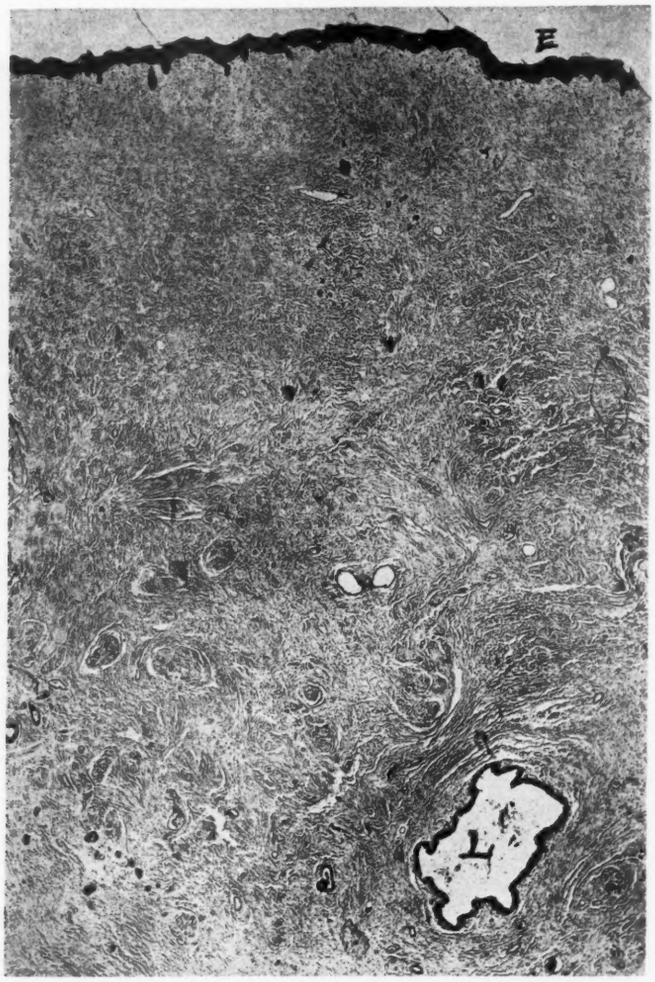


Fig. 9. Transplantation of nipple nine months after operation; Van Gieson stain; low magnification; E, epithelium; M, muscle fibers; L, lactoferous duct.

If for any reason or combination of reasons the operation is indicated, it is surely justifiable to perform such operation cosmetically and to leave a natural and pleasing, instead of an ugly appearance, especially as this can be done without increase in risk or even added inconvenience to the patient.

FIG. 10.

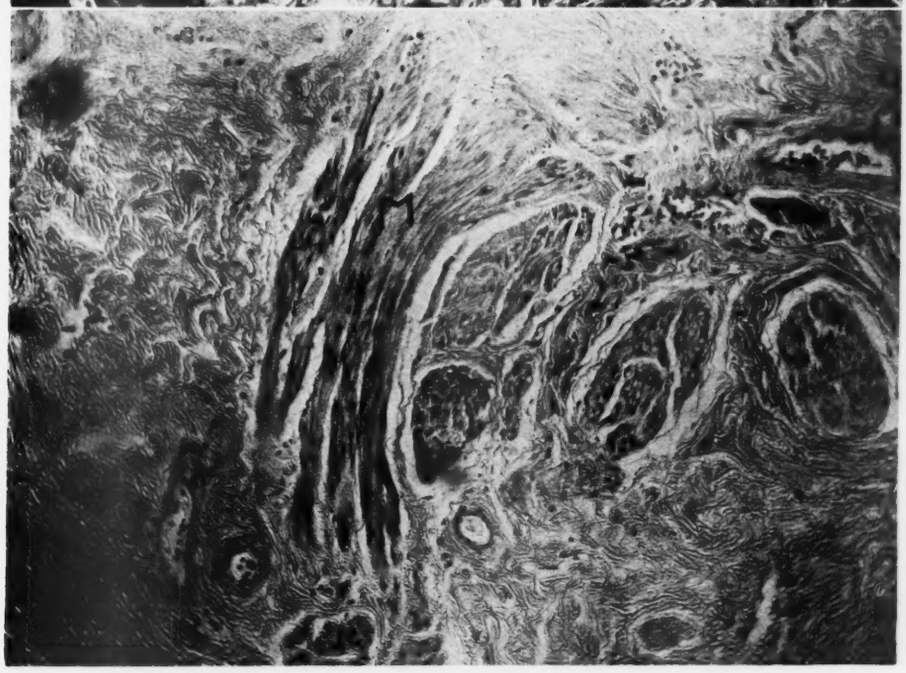


FIG. 11.

FIG. 10. Transplantation of nipple nine months after operation; Van Gieson stain; magnification 150 ×; M_1, muscle fibers in cross section; M_2, muscle fibers in longitudinal section.

FIG. 11. Same as Figure 10, showing muscle fibers in cross and longitudinal sections, stained with Masson stain.

FIG. 12. Transplantation of nipple nine months after operation; elastic fiber stain; low power magnification; E, epithelium; S, sebaceous gland.

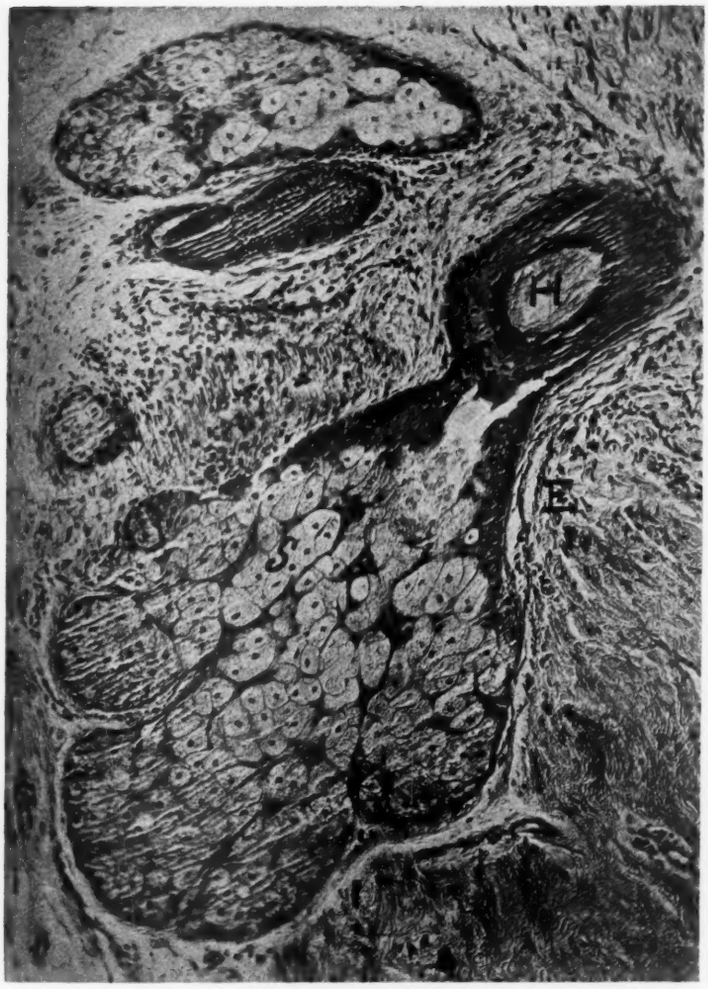


FIG. 13. Transplantation of nipple nine months after operation; elastic fiber stain; magnification 150 ×; S, sebaceous gland; H, hair shaft; E, elastic fibers.

Pertinent Considerations—Anatomic, Physiologic and Pathologic. The causes of enlargement of the breasts are accumulations of fat, insufficiency of the suspensory apparatus and, to a minor degree, hypertrophy of the glandular structure. Usually the excessive accumulation of adipose tissue and the glandular component play the predominating rôle. Some authorities are of the opinion that the fat accumulated in hypertrophied breasts differs in composition from ordinary adipose tissue.

Excessive and persistent enlargement in one or both breasts may occur during adolescence or with pregnancy (Nathanson[13]). Geschickter[14] states that in the diffuse virginal hypertrophy which occurs during adolescence, the mammary enlargement begins about the time of the first menstrual period in the majority of cases, although abnormal growth may occur prior to the onset of menstruation. The enlargement usually progresses rapidly for a period of three to six months. This tremendous overgrowth of the mammary gland is apparently dependent upon the increased sensitivity of the mammary tissue to hormonal stimuli. Hypertrophy may occur at any time, the endocrines and genital function playing an important rôle.

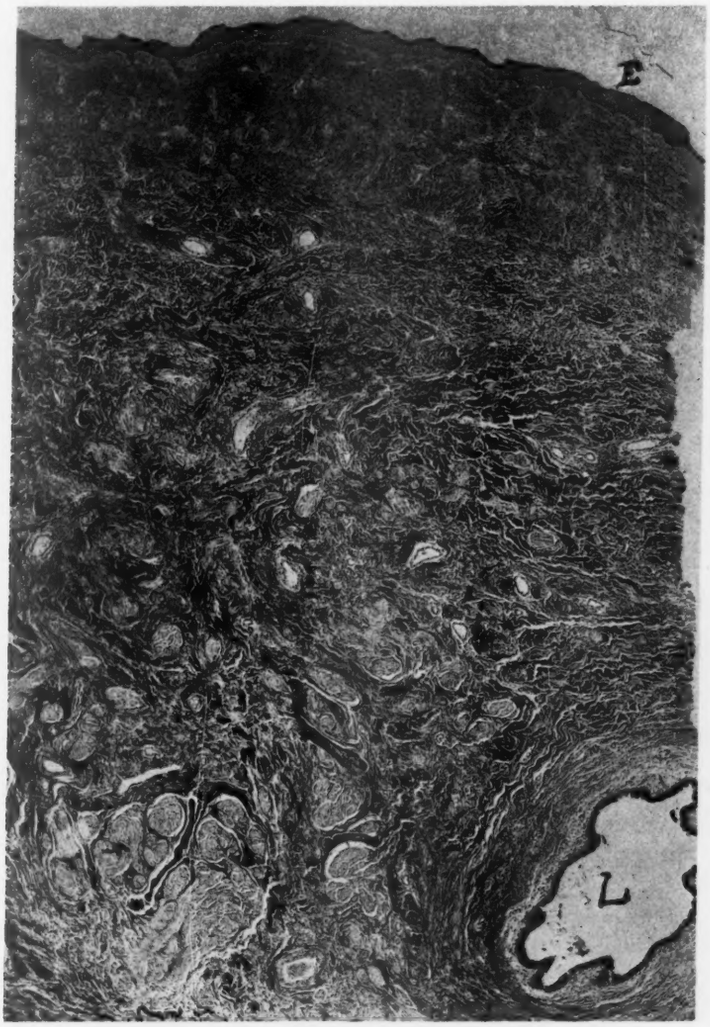


Fig. 14. Transplantation of nipple nine months after operation; hematoxylin-eosin stain; L, lactoferous duct of mammary gland; E, epithelium.

Küster once saw a patient in whom hypertrophy of the breasts followed irradiation of the pelvic organs after an abortion.

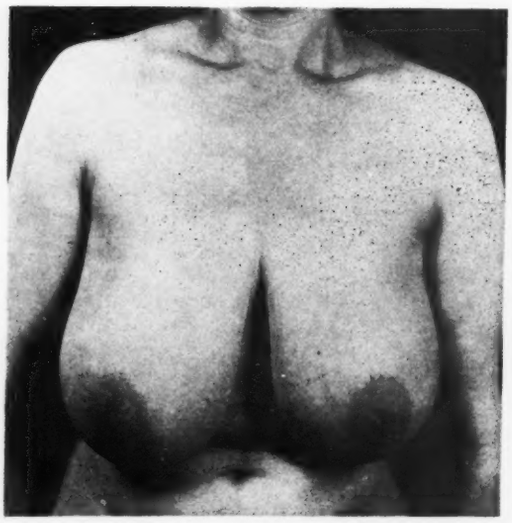


Fig. 15. Virginal hypertrophy of the breasts.

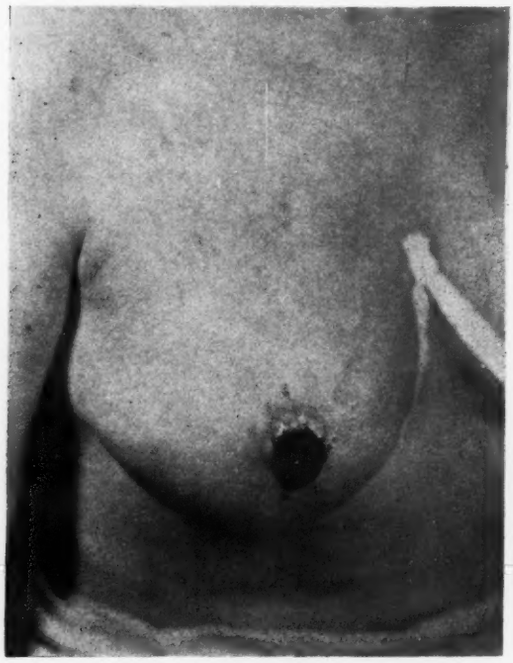


Fig. 16. Same patient as in Figure 15 two weeks after operation showing a satisfactory healing of nipple with beginning desquamation of uppermost layer (stratum corneum) of nipple surface. Note the new nipple underneath in satisfactory healing process.

Virginal hypertrophy of the breasts must be distinguished from adipose breasts or the changes which may occur in cases of pituitary disturbances. In the latter cases there is an increase of fat about the hips and in the mammary gland, but is not as excessive as in virginal hypertrophy.

Endocrine and other physiologic influence may produce changes that are not uniform throughout the breast. Marked differences may be found in different lobes of the same breast. The dependence of postnatal mammary development upon ovarian function is emphasized by endocrine studies. The estrogen secretion of the

Fig. 17. Same patient as in Figures 15 and 16 three and one-half weeks after free transplantation of nipple. Note almost all of the stratum corneum has been cast off and the new nipple structures are shown.

Fig. 18. "Pancake breast"; insufficiency of suspension apparatus.

ovarian follicle plays an important part in adolescent development and, with sexual maturity, both estrogenic and luteal hormones combine to produce physiologic changes. The anterior pituitary gland hormones are important not only to stimulate and maintain ovarian function but also to activate lactation. They seem to be essential, moreover, for the response of the mammary gland to the ovarian hormones. Testicular and adrenal cortical hormones may also induce changes in the mammary gland.

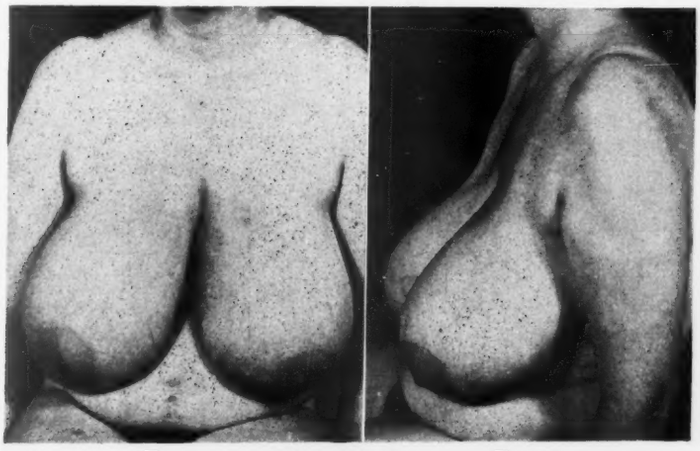


Fig. 19. Fig. 20.

Figs. 19 and 20. Examples of marked hypertrophy of the breasts causing physical distress.

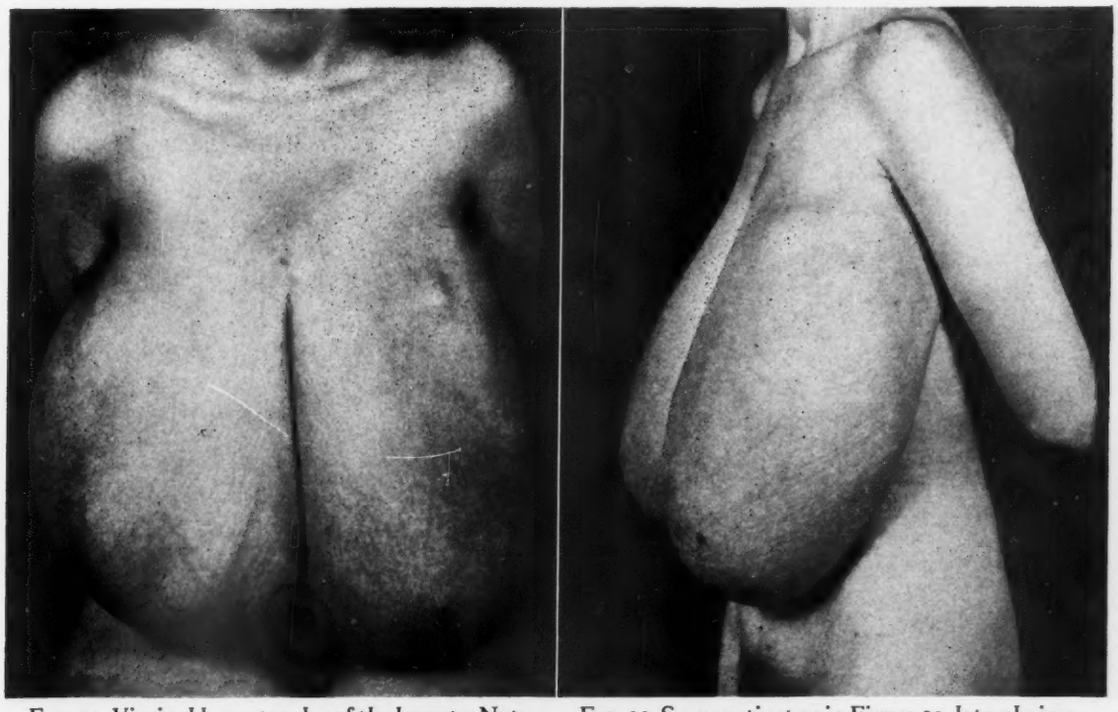


Fig. 21. Virginal hypertrophy of the breasts. Note lobular tumor in left upper quadrant of the left breast.

Fig. 22. Same patient as in Figure 21, lateral view.

CASE REPORT

O. B. A young woman eighteen, started to menstruate four years previously, every other month. For the last year she has been

gaining weight due to increase in size of the breasts, which was especially rapid for the past six months. (Figs. 21, 22 and 23.) The enlargement of both breasts, the left breast measuring 15.5 by 11 by 5 inches; the right breast measuring 15 by 11 by 4½ inches. The

FIG. 23.

FIG. 24.

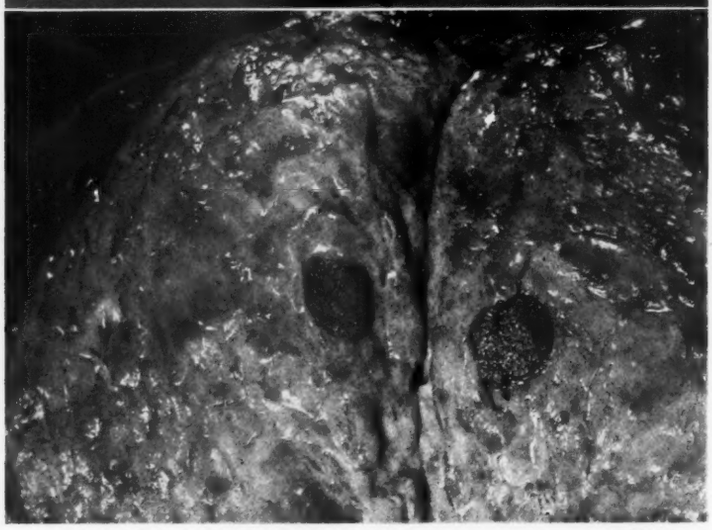


FIG. 23. Same patient as in Figures 21 and 22; patient is reclining.
FIG. 24. Gross appearance of breasts of patient in Figure 23 after removal; note tumor in center of field.

preoperative diagnosis was massive liposarcomatosis of both breasts.

The operation was done in two stages. Following removal of the enormous breasts, both nipples were transplanted to properly prepared beds, but because of threatened shock further operation on the right breast was postponed. Eight days later the operation on the right breast was completed and the patient made an uneventful recovery.

The *pathologic report* by Dr. Paul D. Szánto was as follows: Macroscopic: Symmetrical weight of the left breast was 31 pounds; of the right breast 32 pounds.

The skin covering the breasts presents a thickening of the epidermis and derma. The nipples are not very prominent. The skin is somewhat wrinkled. On the cut surface of the subcutaneous fat tissue there are several distinctly encapsulated tumors present which are prominent and have a greyish cast. (Fig. 24.) A third small specimen taken from the axilla measures 3 by 2 cm which on the cut surface shows a greyish color.

Microscopic Examination: For microscopic examination, ten blocks were taken from different parts of the breasts, including blocks from the encapsulated tumor and from the specimen taken from the axilla. The microscopic sections showed a uniform picture in the sections of the blocks taken from the different parts of both breasts. The histologic picture is characterized by a marked hyperplasia of the lobular tissue. The perilobular and the periacinous connective tissue is cellular and loose. Some of the ducts are dilated and some of these are filled with degenerated débris. Both the larger and smaller ducts show proliferation of the epithelial cells. The encapsulated tumor presents exactly the same histologic picture as the breast tissue between the tumors. Sections from the specimen of the axilla reveal also an identical picture. (Figs. 25 to 29.)

Diagnosis: Virginal hypertrophy of the mammae, with multiple fibroadenomas and hypertrophy of the accessory breast gland in the axilla; no signs of malignancy.

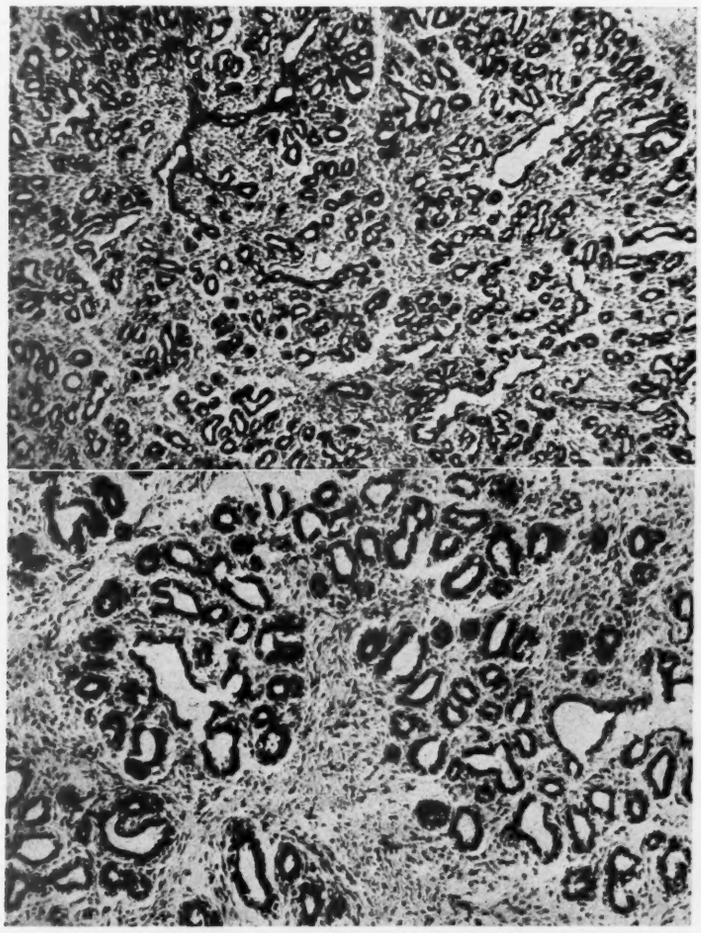


Fig. 25.

Fig. 26.

Fig. 25. Virginal hypertrophy of the breasts; marked lobular development of the breast gland and proliferation of interlobular connective tissue.

Fig. 26. Same as in Figure 25. The lobules are very distinct; the proliferation of the interlobular connective tissue is marked and very cellular (× 80).

Comment. The microscopic picture of diffuse virginal hypertrophy is characterized by a duct hypertrophy with marked proliferation of the periductal fibrous tissue. In the case here reported, the breast tissue showed also a marked hyperplasia of the lobular tissue which is somewhat unusual for virginal hypertrophy. However, a similar case, with almost identical

histologic findings has been reported by Geschickter in his monograph.[14] The combination of virginal hypertrophy with tion of interlobular and periductal connective tissue. In the second part of the menstrual cycle, the hormone of the corpus

Fig. 27.

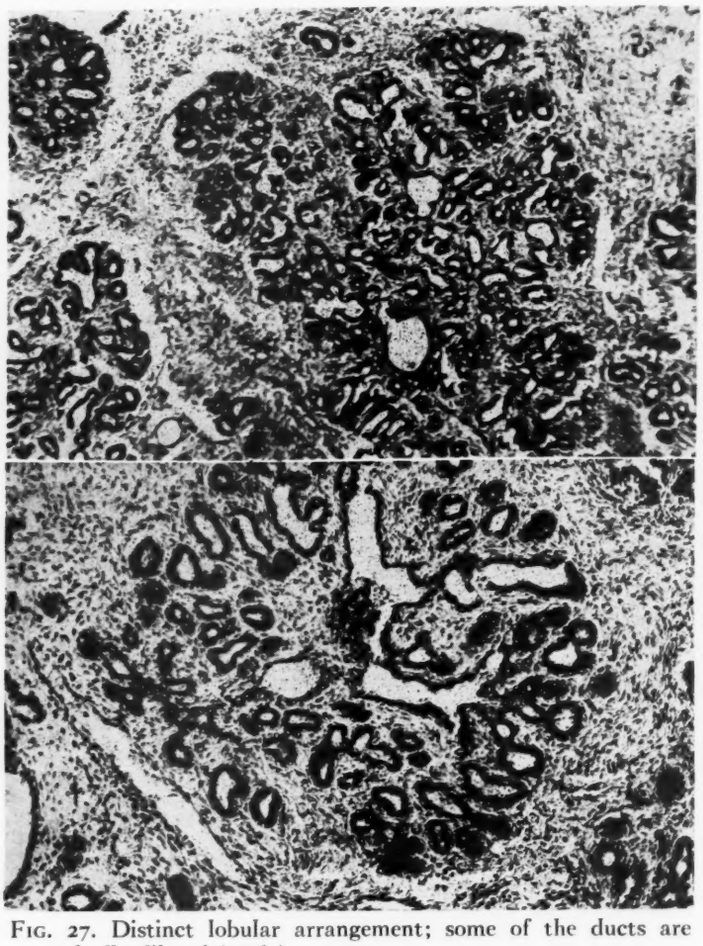


Fig. 28.

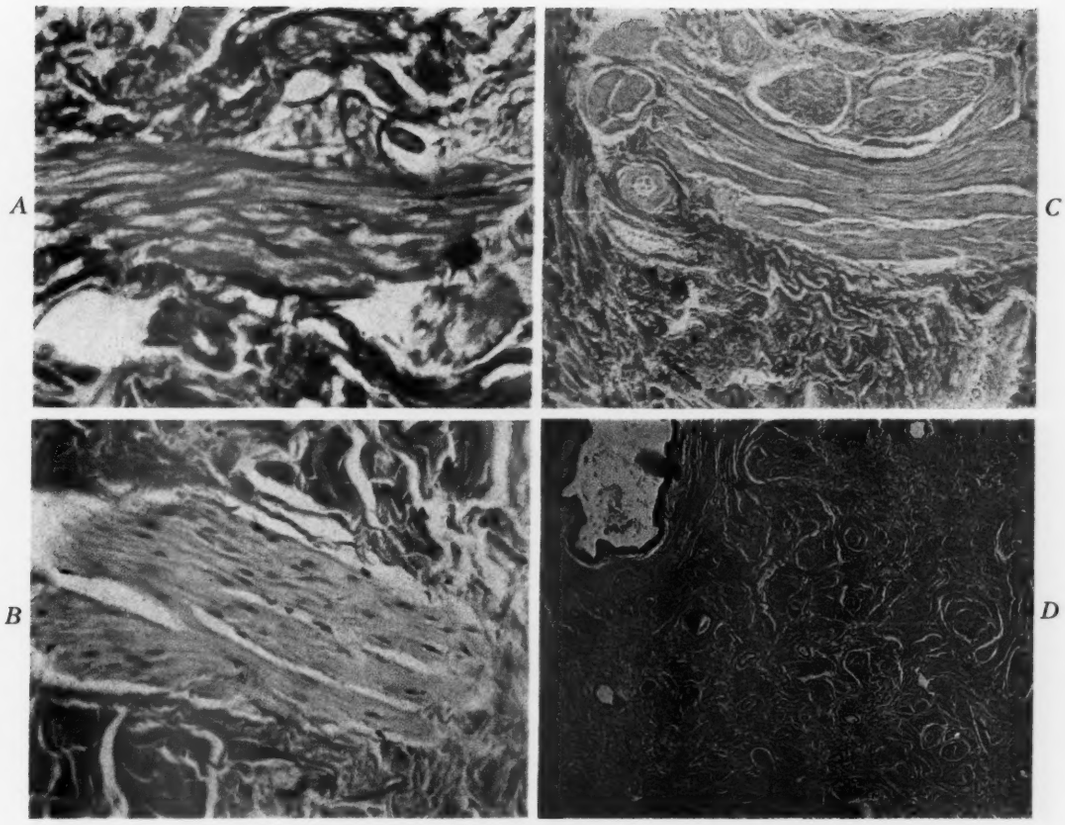
Fig. 27. Distinct lobular arrangement; some of the ducts are markedly dilated (× 60).

Fig. 28. This microphotograph represents one lobule, consisting of distended duct. The inter- and intralobular connective tissue is very cellular (× 80).

fibroadenoma is not unusual. It has been reported by Johnston and Bloodgood.[30] It is explained as a localized response on the part of one of more segments of the breast to an increased hormone production of the ovaries.

Because of the marked hyperplasia of the lobular tissue, there is a possibility of an increased pregnandiol production. It may be recalled that the breast shows marked cyclic changes under the influence of ovarian hormones. In the first two weeks of the menstrual cycle of the estrin production of the ovary will result in a proliferation of the products, with proliferaluteum, the so-called pregnandiol, influences the proliferation of the acini.

In our case, the results of the endocrinologic examination were disappointing. In the twenty-four hour urine specimen we found between five to ten international estrin units, which represents the lower level of the normal. The pregnandiol determination was made just before the irregular menstruation of the patient started, which is the best time for such determinations. No pregnandiol could be found, however, in the urine. The negative results of these hormone determinations do not, however, rule out a disturbance of



Microscopic sections of transplanted nipples showing the presence of nerves, muscle and milk ducts (see also microphotographs in monochrome in text).

A. Nerve tissue. Mallory stain. High power magnification. Bundle of nerve tissue stained red running transversely across field. Tissue stained blue, represents fat.

B. Muscle tissue. Van Gieson stain. High power magnification. Here the muscular tissue is stained yellow, but the nuclei appear brown. Brick stained tissue surrounding muscle represents connective tissue.

C. Muscle and nerve. Masson stain. High power magnification. Here transversely running muscle bundles are seen stained a light green color. Structures as seen in cross section are nerves. On the left below the cross section of a nerve bundle the cross section of a blood vessel is seen.

D. Galactophorous duct. Van Gieson stain. To the left a milk duct is seen in longitudinal section. Numerous blood vessels, capillaries and nerves, as well as connective tissue compose the rest of the field.

the ovarian function. The functional disturbance of the ovary may last several months or years, or may disappear, and after its disappearance the morphologic precipitation of the ovarian dysfunction may remain. Applied in our case, we may say that there is a probability that several months ago, the patient did have an ovarian disturbance, which, however, has now disappeared.

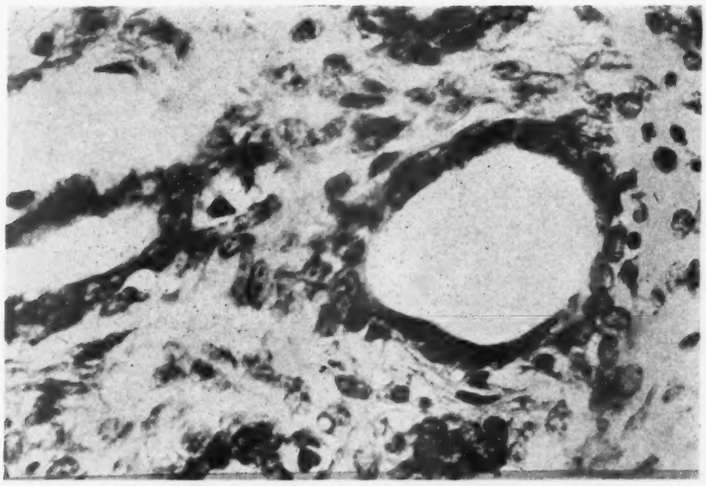


Fig. 29. This microphotographic enlargement presents two acini lined by cuboid epithelium. The vesicular nuclei of the intralobular connective tissue are clearly visible.

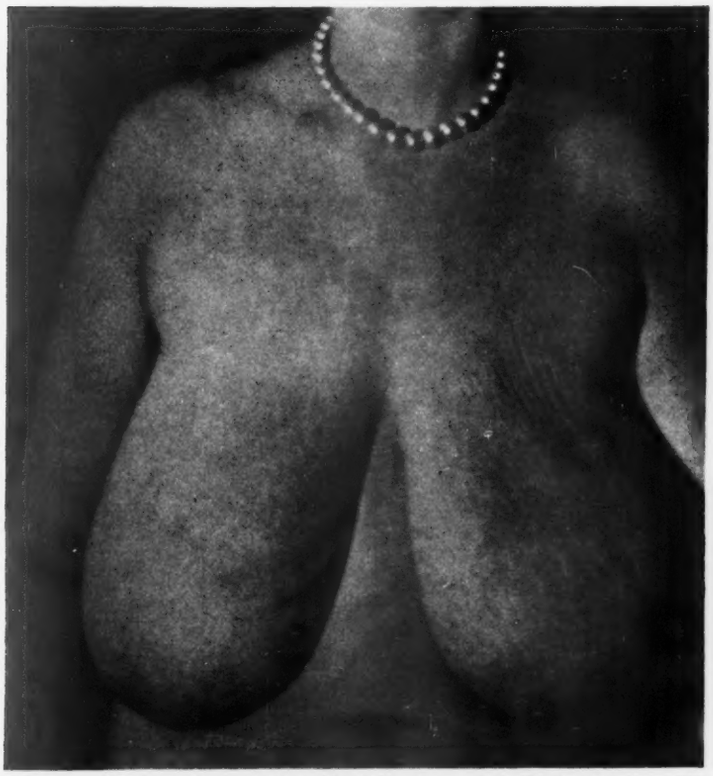


Fig. 30. Marked degree of virginal hypertrophy of the breast with "pancake" compression in the upper segment.

An understanding of the nature of the suspensory apparatus of the breast is important in these enormous hypertrophies of the breast. This suspensory apparatus

is not always found as described in textbook diagrams. The suspensory arrangement of the breast was first described by Sir Astley Cooper. Giralde speaks of a *ligamentum suspensorium mammae* which forms a special division of the superficial thoracic fascia, beginning at the clavicle and extending to the superior border of the breast where it divides into an anterior and posterior sheath which envelopes the breast. It is on this basis that the movements of the breast are synchronized with those of the shoulder girdle. Testut (cited by Girard) observed that this suspensory ligament is at times well developed and at others just slightly indicated. It is most pronounced on the posterior surface of the

FIG. 31. Same patient as in Figure 30 after operation. Note desquamation of uppermost layer (stratum corneum) of nipple with normally healed nipple structure underneath.

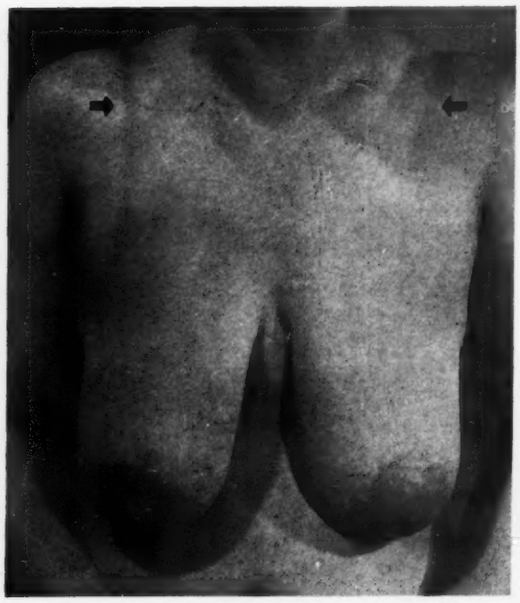


FIG. 32. Breast hypertrophy; patient complained of pulling sensations, and from pressure symptoms of brassieres. Note arrows pointing to impressions from the straps.

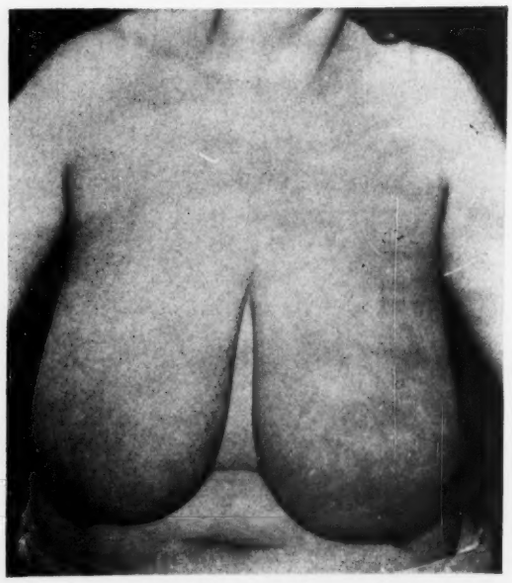


FIG. 33. Virginal hypertrophy of the breasts.

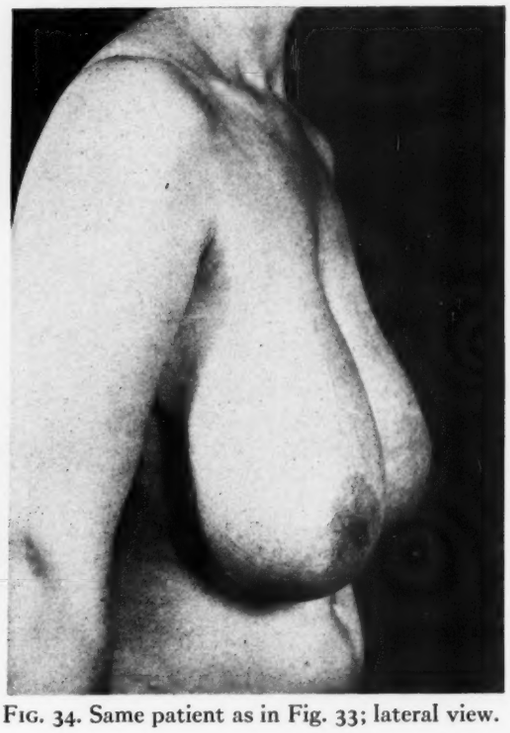


FIG. 34. Same patient as in Fig. 33; lateral view.

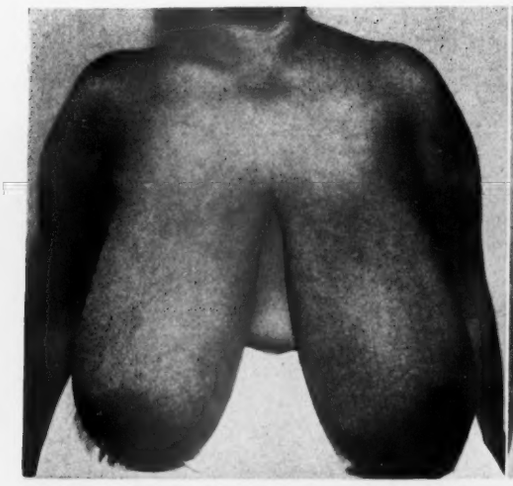


Fig. 35. Virginal hypertrophy of the breasts causing interference with functions. (Author's Service, Cook County Hospital, Chicago, Illinois.) Before operation.

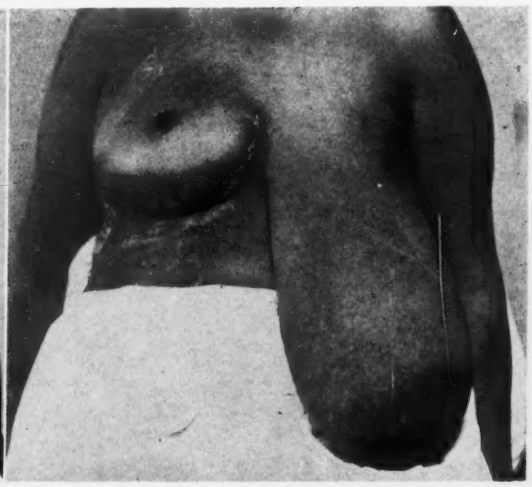


Fig. 36. Same patient as in Figure 35 after one breast had been operated upon by the author's method (free transplantation of the nipple and mammaplasty).

Fig. 37. Virginal hypertrophy of the breast, before operation. Note tremendous enlargement of breast and venous engorgement. The breasts descend to the level of or a little lower than the umbilicus. In a sitting position the breasts are below the umbilical area. The outlines on the breasts are guides for the incision in the formation of the anterior flaps.

Fig. 38. Same patient as in Figure 37 twelve days after operation. Note discoloration of nipple which is only temporary affecting the uppermost layer (stratum corneum) of the nipple. This becomes desquamated and a nipple of normal color is exposed.

breast, but in practice is sometimes difficult to demonstrate. Küster believes that the principal factor in suspending the

Fig. 39. Patient shown in Figures 37 and 38 three weeks after operation. Note progressed desquamation of stratum corneum.

breast is the skin covering it, which sends into the gland structures, fibrous tissue septa in a comblike manner. The posterior surface of the breast is connected to the pectoral muscle by means of a layer of very loose areolar tissue, which permits greater mobility. This plays a minor rôle in suspending the breast.

It is apparent that the weight of a large accumulation of fat and fibrous tissue in the breast so stretches the suspensory apparatus that the breast descends and prolapses, the degree depending upon the degree of tissue accumulation. In some instances the breasts have reached below the umbilicus. Hypertrophy of the breasts is often observed while the rest of the body remains in perfectly normal proportions. Loss of weight through diet and medical means may, on occasion, be effective in reducing the breasts. However, this usually fails and creates an unesthetic condition of flap-like skin bags, which I have described as "reduction bags." (Fig. 18.)

The blood supply plays a very important rôle in plastic surgery of the breast. Necrosis may result if the branches of the in-

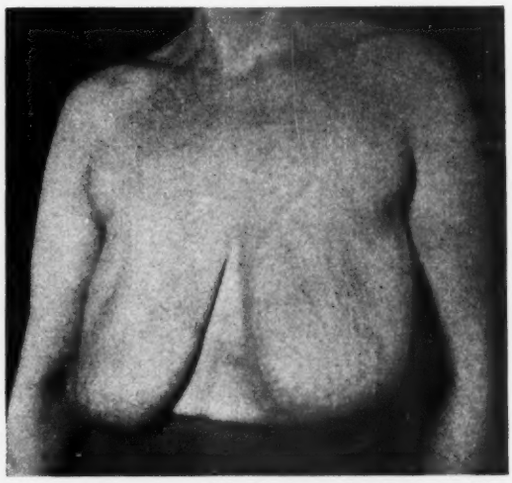


Fig. 40. Breast pendulosity; so-called "pancake" breast, the result of compression for many years with tight fitting brassieres. Multiple stage operations do not, as a rule, yield good results in these cases. Satisfactory results are obtained by simple plastic reconstruction of the breast. (Lotsch, Kraske, etc.)

ternal mammary artery are encroached upon, of, if on the lateral aspect, vessels entering the breast from the axillary line are injured. Ansom, Wright and Wolfer[15] summarize their discussion of the blood supply of the mammary gland: "(1) The mammary gland receives its blood supply from two chief sources, namely, the anterior perforating branches of the internal mammary artery, and the mammary rami of the axillary artery itself or one of its main stems. (2) The mammary rami of the anterior perforating arteries form a transversely arranged series, extending from the first to the fourth intercostal spaces. (3) The mammary branches of the axillary artery leave the axillary fossa together; accompanied by the corresponding veins they form a small 'pedicle' of vessels. (4) Upon the breast the mammary vessels occupy the most superficial level of the fatty tissue, being virtually subcutaneous in position. (5) From these various mammary rami smaller twigs are given off, at a right angle, into the substance of the gland; the more prominent of these are

traceable into the mammary tissue to a depth of approximately 2.5 centimeters. (6) Both upon the surface of the gland, and within its substance, anastomotic communications between neighboring rami are common. (7) None of the so-called medial mammary branches of the anterior intercostal arteries pierce the pectoral musculature to reach the overlying mammary gland; they terminate as muscular branches, leaving the deep or thoracic aspect of the gland devoid of arteries of gross proportions. (8) Similarly, none of the pectoral rami of axillary derivation pass from the deep level through anterior pectoral muscles to supply the mammary gland. (9) No vessels reach the gland from the inferior aspect; they approach the gland only from the medial and the superolateral aspects."

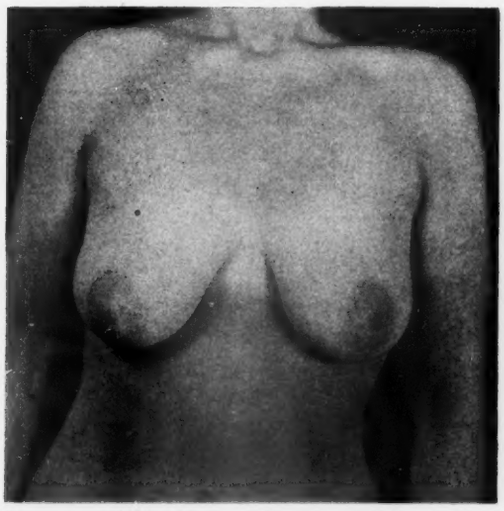


Fig. 41. Mild degree of mastoptosis; in such cases the Lotsch operation may be done.

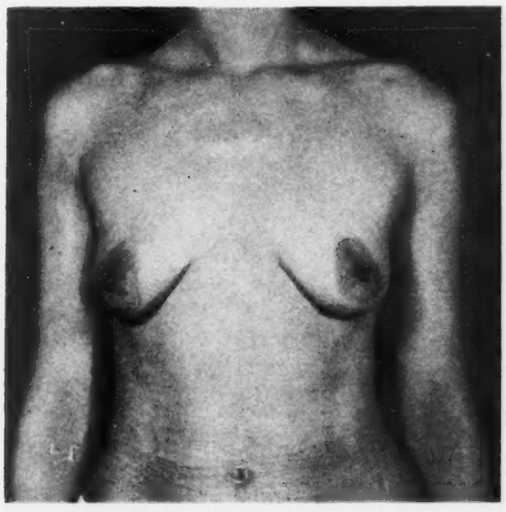


Fig. 42. Here also the Lotsch procedure may be attempted.

From the surgical viewpoint, Wolfer says: "Plastic procedures which are designed to elevate a large pendulous breast can be carried out with comparative safety so far as the blood supply is concerned, since there exists inferiorly an area in which vessels are few in number. For this reason, also, excision of breast tissue should be made from the inferior, not from the superior portion."

The nerves of the mammary gland have been studied by Eckhardt. The vagosympathetic innervation is not well described, although its rôle seems quite well known. It is capable of exciting the nipple reflex and may regulate the galactogenic hypophysary secretion. The reflex follows the sensory path because experimentally and clinically it has been observed that the interruption of the motor path does not cause any disturbance in the reflexes.

As to the function of the breasts, it is well known that hypertrophied breasts are of little value as far as lactation is concerned. Such breasts are, as a rule, functionally inactive organs. It has been noted by many authors that women with hypertrophied breasts who have given birth to children often find that they are unable to nurse them (Girard). Thus the impression that large breasts denote good function is not based on fact. If after reconstructive operations on the breast the lactophorous function is lacking, it would seem that no great change in this respect has been suffered. Some instances have been recorded in the literature of pregnancy and lactation occurring after plastic surgery on the breast, but no promise of such result can be held out to the prospective patient.

Instances have been noted in which improvement in the general condition of the patient has occurred, and especially

in those conditions generally associated with greatly enlarged and pendulous breasts, after a considerable portion of the breast

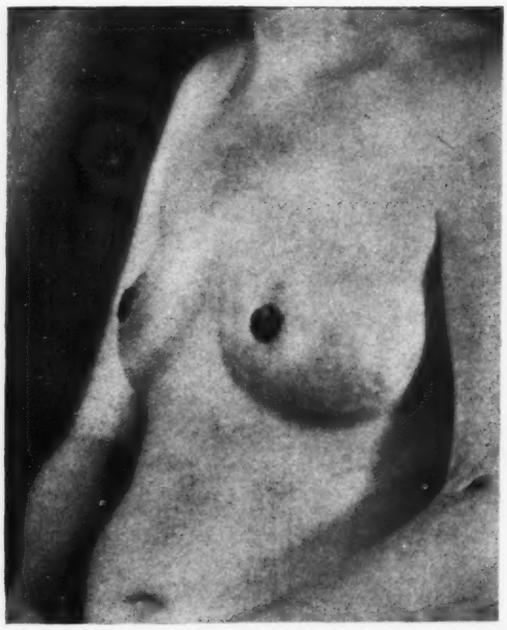


Fig. 43. Results in mild degree of mastoptosis from the Lotsch transposition of the nipple operation.

Fig. 44. Unfortunate results of an attempt by an inexperienced operator to do a plastic operation on the breast. Note necrosis of the breast tissue and transplanted nipple in the axilla. From Thoreks' "Plastic Surgery of the Breast and Anterior Abdominal Wall," courtesy of Charles C. Thomas.

substance has been removed, although it may be difficult to explain the connection between the operation and such improvement.

The ideal results one aims to accomplish in plastic reconstruction of the breasts are: (1) The newly reformed breasts must

Fig. 45. Same patient as in Figure 44, displaying the other breast. Note total necrosis of the nipple, sloughing and infection in the lower segment of the breast. From Thoreks' "Plastic Surgery of the Breast and Anterior Abdominal Wall," courtesy of Charles C. Thomas.

be situated in their normal position. (2) They must be able to function (endocrinologically). Enough tissue is left behind in a properly performed reconstruction operation to assure endocrine function. (3) The breasts must have the form and size of the normal breast and no injury to the blood and lymph vessels must result. (4) The scars should be as inconspicuous as possible. (5) Both breasts should be symmetrical. All of these results can be achieved by proper technic. (Figs. 30 and 31.) Types of breasts in which author's operation yields gratifying results are shown in Figures 32 to 38.

Reconstruction operations on the pendulous breasts may be divided into four principal types: (1) Procedures aiming to suspend the breast (after proper dissection)

to the costal cartilage of the second and third rib (Girard). (2) *Transpositions* of the nipple with remodelling of the breast tissue (Lotsch, Kraske, Axhausen and others). (Figs. 40 to 43.) In minor degrees of prolapsus the Lotsch operation may be resorted to. In more pronounced cases such operations will often prove unsuccessful. (3) The third variety, of which the Lexer-Hollander and Joseph operations are representative, consist of an incomplete detachment of the connections between the breast, nipple, and skin-covering, followed by reconstruction of the form of the breast by excision of the required amount of tissue, and finally by proper flap placements. These are the two-stage and occasionally *three-stage operations* (Joseph). The results are often not satisfactory from an esthetic point of view.

The conscientious surgeon will familiarize himself thoroughly with all recorded technics. In plastic reconstruction of the female breast, it is not sufficient to possess an accurate knowledge of anatomy and physiology; such knowledge must be supplemented by special surgical training. Furthermore it is essential that the surgeon possess a definite sense of innate artistry, because this type of surgery represents the highest degree of surgical sculpture, if such term be permitted. The patient has a right to demand the very best possible esthetic result. Only by giving these distressed and often despairing individuals the consideration to which they are entitled and offering to them the benefits of plastic surgery at its best can the charlatans and imposters be excluded from a field which lay undeveloped and discredited for too long a time because of their failures and the resulting disfigurements.[31] (Figs. 44 and 45.)

This discussion of plastic surgery of the female breast would be incomplete without a mention of the underdeveloped breasts in which derma-fascia transplants may be used to advantage.[16]

There are, of course, contraindications to plastic surgery of the breast. Among them are pulmonary, cardiac, renal, and metabolic diseases. A definite contraindication is a surgeon not specially trained in reconstructive surgery. Under no circumstances should the operation be undertaken unless specifically indicated and no contraindications exists, and unless the surgeon be thoroughly qualified to perform it.

SUMMARY

1. Twenty-five years of experience with plastic reconstruction of the breast with free transplantation of the nipple, an operation devised by the author, are described and evaluated.

2. In minor degrees of prolapsus of the breasts, the Lotsch operation may be resorted to.

3. In marked prolapsus and in marked hypertrophies, the author's operation compared with other methods yields gratifying results.

4. The author offers additional proofs that the transplanted nipple survives.

5. Technical details and safeguards for avoiding failures are pointed out.

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Malignant tumors of the breast grow more rapidly and are a greater hazard during pregnancy. In general, the younger the individual, the more rapidly a cancer of the breast will grow. This rapidity of growth makes the prognosis more grave in this group.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

THE USE OF THIOURACIL IN HYPERTHYROIDISM*

TEN ILLUSTRATIVE CASES

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THE introduction of thiouracil† in the treatment of hyperthyroidism has awakened greater interest in the field of thyroid surgery than there has been at any time since Plummer suggested the use of Lugol's solution in 1922. Although little more than a year has elapsed since Astwood[1] first reported the treatment of three thyrotoxic patients with this drug, several studies on this subject have appeared in the literature. The majority has enthusiastically endorsed the use of thiouracil; but the fact that agranulocytosis has occurred in a number of cases, in at least seven of which there have been fatal results, demands a careful clinical and laboratory study before releasing the drug for general distribution. The 1,300 and more deaths from agranulocytosis occasioned by the use of the various amidopyrine compounds are still too well remembered to occasion a similar tragedy.

The Lederle Laboratories, distributors of Deracil (thiouracil), have been conducting an intensive pharmaceutical and clinical investigation of the drug during the past two years. In a recent communication Dr. S. M. Hardy,[2] assistant medical director of Lederle, advises that thiouracil has now been used in nearly 2,000 cases, the results in approximately 84 per cent being beneficial. He states that despite the seven fatal cases of agranulocytosis the medical consensus is that this drug is too valuable for the control of thyrotoxicosis to be discarded because of occasional, although admittedly serious, toxicity. As a consequence, Lederle has decided to continue the laboratory and clinical investigations of the drug for at least the next twelve months.

In 1938, I urged the presidents of two leading pharmaceutical companies to stop advertising and to withdraw the use of their amidopyrine-containing sedative compounds. Several cases of agranulocytosis admitted to the Jackson Clinic had resulted fatally from the use of these preparations. In reply, one of these officials stated that it was very questionable if amidopyrine was an etiological factor and that the drug was too valuable to be withdrawn because an occasional patient might react unfavorably when it was beneficial to so many.

The case is somewhat different with thiouracil. A large number of persons die each year from the effect of toxic goiter, and many others are seriously incapacitated, some permanently. Any drug that might obviate the necessity for surgery or considerably lessen its hazards is worthy of our consideration. Dr. Hardy is proceeding most carefully in his study of the drug and has warned all who have been allotted thiouracil of its potential dangers. He believes that each case should be continuously and carefully watched for symptoms or signs of toxicity, particularly for leukopenia and agranulocytosis. He also believes that it is the responsibility of the individual investigator in each case to decide whether the employment of thiouracil is a greater risk than thyrotoxicosis untreated.

Although thiouracil has been available to me for over a year, I have formed no

† The thiouracil was supplied through the courtesy of the Lederle Laboratories, Inc., Pearl River, New York.

*From the Freda Meyers Nishan Foundation for the study of goiter of the Jackson Clinic. Presented before the meeting of the Western Surgical Association, Chicago, Dec. 2, 1944.

definite conclusions as to its beneficial or harmful effects. It appears that at least another year must elapse and a considerably larger series must be studied before a proper evaluation of thiouracil may be ascertained. Probably my inability to achieve more brilliant results has been due to a hesitancy to subject many of my patients to what I considered an unnecessary risk. Undoubtedly, a quicker and more favorable response could have been obtained with considerably larger doses of the drug. Yet I have been surprised to read of the very large doses used in some cases which clinically suggested non-toxic adenomas.

A B

FIG. 1. Case 1. A and B, recurrent exophthalmic goiter with nerve paralysis controlled by thiouracil.

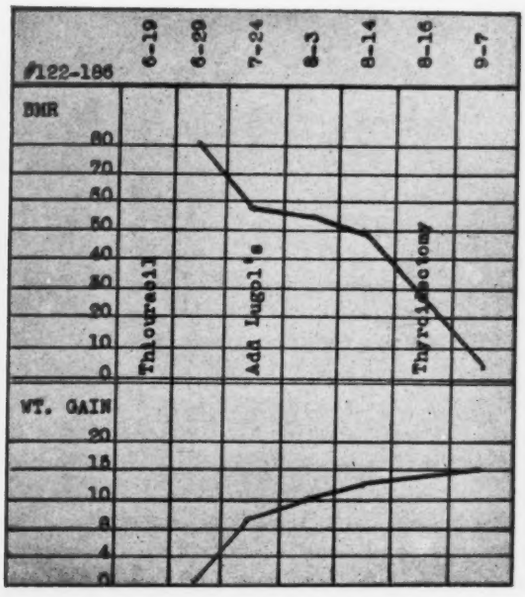
STUDY OF THE CLINICAL REPORTS

Following Astwood's[1] report in 1943 of the use of thiouracil in thyrotoxic goiter, there appeared a study by Williams and Bissell[3] of nine similar cases that clinically responded favorably and showed a drop in the basal metabolic rate returned to a point at or near normal following the use of thiouracil. Twenty days to six months was necessary to accomplish this result. No ill effects were observed. Patients with either primary hyperthyroidism or adenomatous goiter with hyperthyroidism responded equally well. He further observed that clinical improvement preceded a drop in the metabolic rate; that the gland remains the same in size and consistency; that thrills and bruits persist and that failure of the primary hyperthyroid gland to involute causes considerably more bleeding and technical difficulty at operation. Bartel believed that the preoperative use of thiouracil in severe hyperthyroidism did shorten the time of treatment, reduce the hospital stay (open to question), and limit the procedure to a subtotal thyroidectomy. Gabrilove and Kert[5] reported on the use of thiouracil in nine cases in three of which toxic reactions occurred. Paschkis[6] and his associates reporting in Endocrinology, May 1944, found in a study of twenty-one cases of thyrotoxicosis that the disease can be suppressed with either thiourea or thiouracil. The former proved to be more toxic and was discontinued.

Next, Williams and Clute[7] reported on the treatment with thiouracil of seventy-two patients with thyrotoxicosis, the majority of whom obtained a normal rate and remission of the disease. An average of five weeks was required to bring the

metabolic rate to normal in the severe cases and but three weeks in the mild ones (+15 to +35 per cent). Sixteen patients were treated for more than six months. In four patients who discontinued therapy after a few months a relapse occurred in about three weeks, but a remission was again obtained with thiouracil therapy.

A



B

FIG. 2. Case II. A and B, a severe case of iodine-fast exophthalmic goiter responding well to thiouracil.

Great interest was manifest in the exhibit on thiouracil presented by Williams at the convention of the American Medical Association in June, 1944, at Chicago, and in recognition a silver medal was awarded.

Moore[8] and his collaborators concluded from a study of twenty-six thyrotoxic patients that thiouracil was superior to iodine in the preparation of patients for operation.

Then followed successive reports in the Bulletins of the McGregor,[9] Lahey,[10] and Jackson Clinics[11] on the experiences of these institutions with the drug.

Goldsmith[12] et al. suggested the use of liver or folic acid in the prevention and in the treatment of the thiourea induced granulocytopenia.

The American Medical Journal[13] recognized the growing interest and importance of this subject with an editorial in the September 16, 1944 issue. The editorial concluded by saying that whether or not thiouracil will prove to be a satisfactory substitute for surgical treatment of toxic goiter cannot be stated on the basis of the present limited experience. The drug promises to be of great value in cases in which operation is inadvisable or contraindicated.

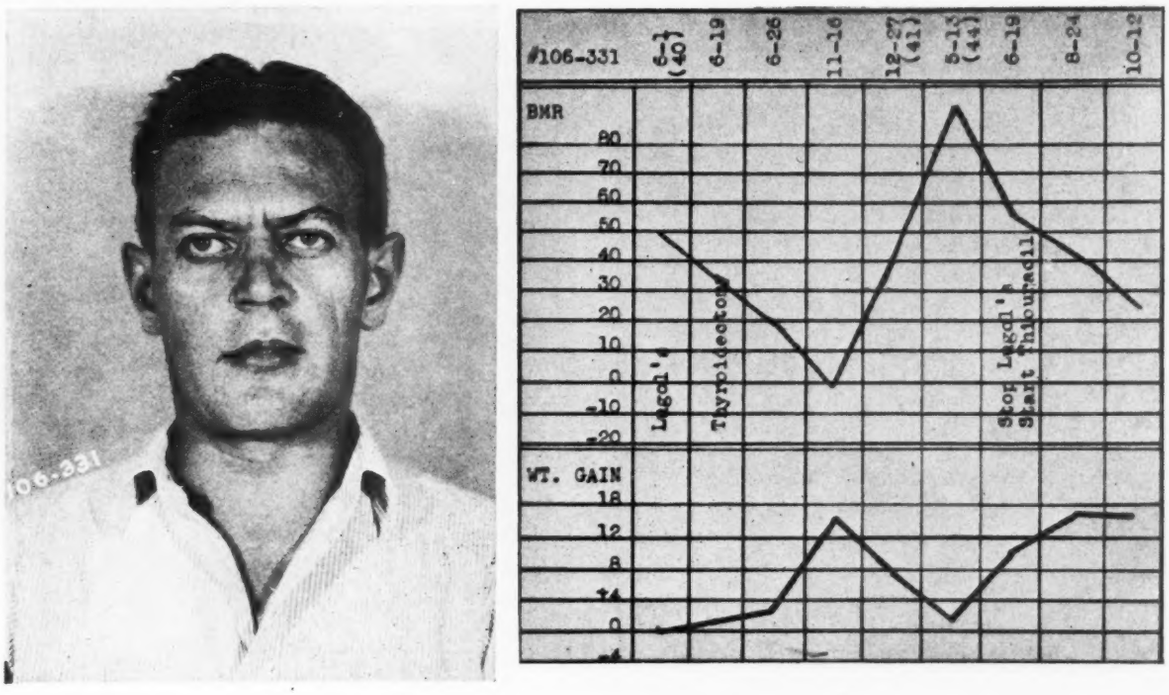
In the same issue of the journal appears a report by Reveno[14] of nine cases of toxic adenoma treated with thiouracil. Six showed a satisfactory response, and three were failures.

Kahn and Stock[15] reported a fatal case of agranulocytosis resulting from thiouracil.

Cannon[16] found that in two patients with hyperthyroidism treated with thiouracil there was marked improvement.

Clute and Williams[17] presented their study of this subject before the American Surgical Association meeting in May, 1944, and this paper appeared in the October Annals of Surgery. Their conclusion was that this drug is a valuable addition to our means of treating hyperthyroidism and for

preparing patients with this condition for surgery. The late results in the operative cases were excellent.



A B

FIG. 3. Case IV. A and B, a recurrent case of exophthalmic goiter under control by thiouracil.

In the November issue of the Medical Clinics of North America appears an article on the "Treatment of Thyrotoxicosis with Thiouracil" by Dr. Karl E. Paschkis,[18] of Jefferson Hospital, Philadelphia.

This rather detailed summary of the clinical literature on this subject is, I believe, the first to be presented and is important because of the controversial points that have arisen, the number of fatalities that have occurred, and the need for further careful study and evaluation of this drug.

DOSAGE

In the first thirty patients treated by Clute and Williams[7] the initial dosage of thiouracil was usually 0.1 Gm., but with subsequent patients it was increased to 0.4 Gm. or 0.6 Gm. daily. In most cases, however, the dose was reduced to 0.2 Gm. daily over a period of about six weeks. Single doses usually consisted of 0.2 Gm. although they were sometimes only 0.1 Gm. When several doses were given daily, they were spaced evenly. Within the range of the dosage employed, the drug has not been found to accumulate appreciably in the blood in spite of severe disease of the kidneys and liver.

There has been no uniformity of agreement as to the dosage. Thus Paschkis[18] found in most cases that 0.1 Gm. of thiouracil was effective, whereas Reveno[14] employed 0.8 Gm. and Bartels[4] observed no toxic effect from the daily dose of 0.6 Gm.

In my own experience I have been unable to standardize on any dosage, believing so far that each case must be judged individually depending upon age, duration and severity of symptoms, whether or not the patient has previously received iodine, the type of hyperthyroidism, et cetera.

In treating eleven year old children with rather severe primary hyperthyroidism and in treating several elderly persons with advanced, multiple, toxic adenomas, I have believed that a dosage of 0.6 Gm. or 0.8 Gm. carried a considerable risk and that it was safer to begin with

0.1 Gm. or 0.2 Gm. and gradually increase the dosage to 0.4 Gm., and then as soon as the hyperthyroidism was controlled, to again reduce the dosage. Very possibly with larger doses my results would have been more spectacular, but in this small series of cases, thirty now being studied, no serious reactions have occurred. It has always seemed to me that before testing any new medical or surgical procedure on anyone, the criteria should be whether we would employ a similar remedy or method on a member of our own family.

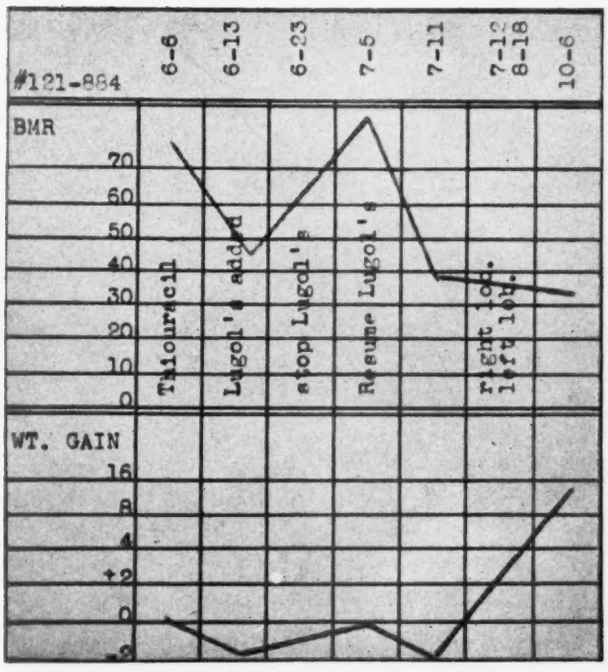


Fig. 4. Case v. A one-stage thyroidectomy was done on this patient with a severe case of exophthalmic goiter.

COMPLICATIONS

As yet nothing has appeared in the literature as to how long one may safely be kept on thiouracil except that Williams[7] has reported sixteen cases on the drug for six months (now perhaps a year). In the case of amidopyrine, certain persons were able to take the drug for months without developing agranulocytosis. Then after stopping a few weeks or months and resuming the drug, toxic reactions occurred. The same has been true of the sulfonamides.

The most common toxic manifestations as observed by Williams and others have been vertigo, headache, nausea, hyperpyrexia, morbilliform rash, pruritis, urticaria, allergic arthritis, edema of the legs, vomiting, enlargement of the submaxillary glands, leukopenia, agranulocytosis, and jaundice. Two questionable reactions have been observed in my series. Following the ingestion of 0.4 Gm. of the drug for two days, a middle-aged male with an exophthalmic goiter complained of severe abdominal cramps, nausea, and vertigo. The drug was stopped, but his disturbance could have been presumably due to other causes. A young girl with a severe, persistent hyperthyroidism despite thyroidectomy developed an unusual skin eruption, the hands and arms assuming a livid crimson color. However, after stopping the drug, the rash cleared up only to return ten days later. Again the drug may not have been responsible.

In order to protect our patients from agranulocytosis, it has been our plan to check the patient's white blood count as well as the general condition every two weeks. However, war time travel condi-

tions often make this difficult. Consequently, we have frequently extended this period to three and even four weeks. Under such conditions one must hesitate before using larger doses of the drug.

A B

FIG. 5. Case IX. A and B, a twelve year old child with exophthalmic goiter, now on thiouracil.

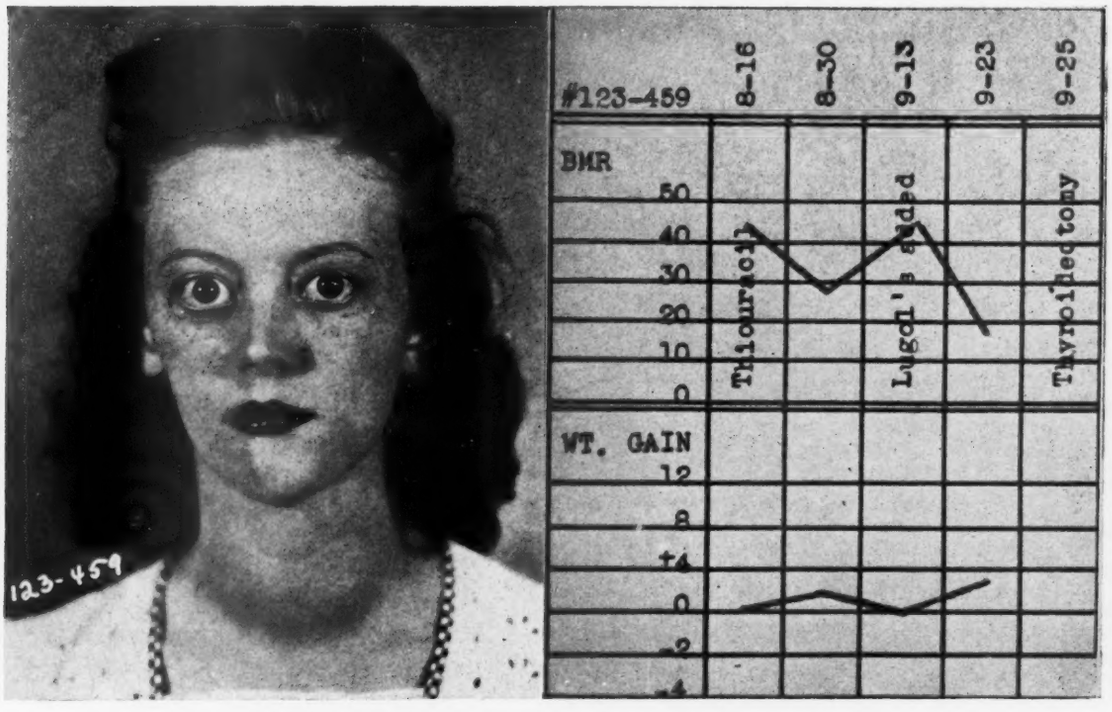
In a communication received from Dr. Robert Williams[19] on October 25, 1944, he states that about 210 patients with hyperthyroidism have now been treated with thiouracil and that the results have been essentially the same as previously reported. Complications were definitely less common in the second hundred cases. Two cases of agranulocytosis were observed, but the other complications have tended to be relatively mild.

William and Bissel[3] reported transient edema with depression of the carbon dioxide combining power of the plasma and elevation of the plasma chlorides. In his discussion of Dr. Clute's paper before the American Surgical Association, Dr. John de J. Pemberton[17] stated that a similar reaction had been observed at the Mayo Clinic in two patients to whom thiouracil was administered because of severe recurrent exophthalmic goiter. The reactions were so severe that the drug was stopped. In one of the cases, the reaction was accompanied by swelling of the face, marked somnolence, muscular twitching, myoclonic spasms, incoherent, slurred speech, vertigo, and severe headache. The reaction occurred on each of three occasions when the drug was given and twice when the basal metabolic rate was normal.

BENEFICIAL EFFECT OF THIOURACIL

Considerable time and space have been devoted to the possible serious effects of thiouracil because it has seemed to me that this phase of the subject has not been sufficiently emphasized. Before considering the possible beneficial effects of this drug in hyperthyroidism, the special indications for its use might be evaluated. Its curative effect may be considered only from the standpoint of primary hyperthyroidism, as obviously it will not cause the disappearance of a multiple, toxic adenoma of the thyroid. Clute and Williams[7] go so far as to state that it is distinctly possible that surgery will in the near future be unnecessary in many patients with exophthalmic goiter. Hardy,[2] how-

ever, is of the opinion that the drug will prove especially useful for the preoperative preparation of patients rather than for severe exophthalmic goiter in the very young and in the aged, in the debilitated, decompensated, et cetera; (4) cases of



A B

Fig. 6. Case x, A and B, a patient with iodine-fast exophthalmic goiter prepared with thiouracil on whom a primary thyroidectomy was performed.

lifelong usage. It would indeed be a boon to mankind if exophthalmic goiter might yield to thiouracil rather than surgery, but from my small experience this is still a hope.

Pemberton[17] has expressed a doubt whether or not the surgical mortality in cases of exophthalmic goiter of moderate or slight severity, already nearly as low as in non-toxic adenomatous goiter, can be lowered by preparation with thiouracil rather than iodine. That doubt seems justified.

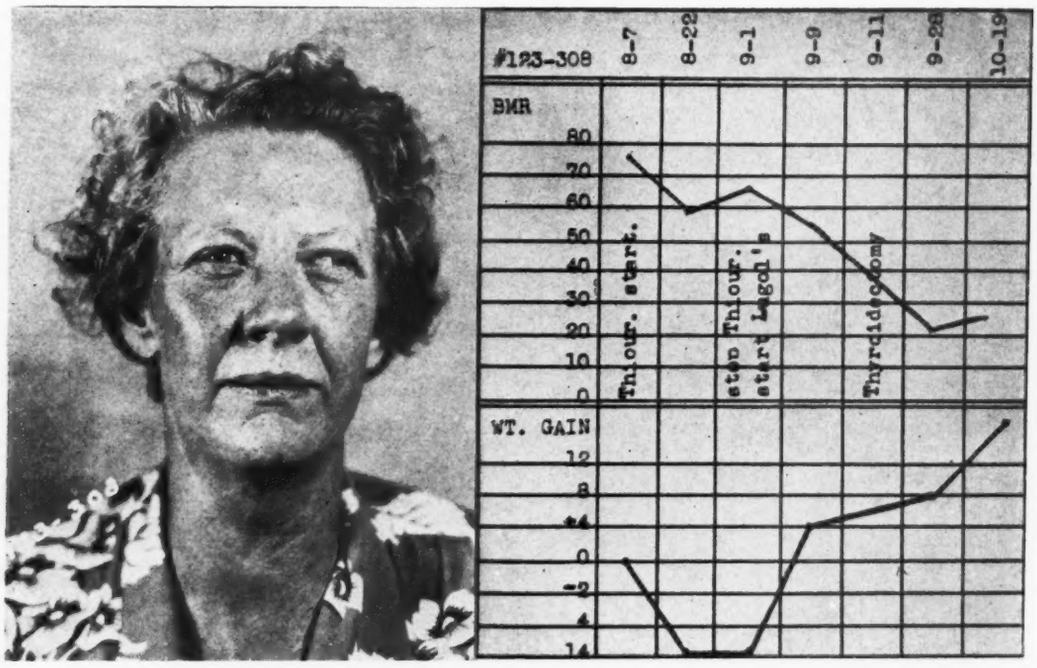
There remain the following groups of cases that might be benefited by thiouracil preparation where iodine has little effect: (1) Advanced cases of multiple toxic adenoma in which there is no response to iodine (reported elsewhere[19]); (2) cases of toxic adenoma complicated by myocarditis, fibrillation, hypertension, diabetes, decompensation, et cetera; (3) cases of exophthalmic goiter in whom because of pregnancy, previous nerve injury, infections, or other diseases it may be desirable to delay surgery and yet not continue on iodine; (5) cases of iodine-fast exophthalmic goiter; (6) cases of recurrent or persistent hyperthyroidism.

Our experience in all these types of cases with thiouracil has proved encouraging. Probably the gravest risk in the surgical treatment of hyperthyroidism has been brought under control. I refer to the cases of advanced toxic adenoma where a two-stage thyroidectomy has usually been required to safeguard the patient. After preparation for several weeks, I have attempted a one-stage thyroidectomy in several of these patients with satisfactory results.

In two children with exophthalmic goiter the disease has been brought under partial control, but following several weeks' treat-

ment there appears to be no indication that a cure will result without surgery.

Three patients with recurrent hyperthyroidism have shown a fine response to thiouracil and for the first time are running normal metabolic rates.



A B

FIG. 7. Case 123-308. A and B, a patient with advanced primary hypothyroidism on whom a primary thyroidectomy was done following the use of thiouracil.

In two patients of the iodine-fast type a primary rather than a two-stage operation was done with little reaction.

Dr. Williams[19] advised me that he has successfully treated four women who were pregnant. One was treated for six months preceding pregnancy and throughout her entire nine months of pregnancy. At no time did she have a toxic reaction to the drug, nor did she have any thyrotoxicosis after the first few weeks of treatment.

The clinical improvement in patients that respond favorably is usually noticeable within a few days after starting the drug, but the response is slower in those who have been on iodine. The change is observed by the patients before a drop in the basal metabolic rate occurs. In some cases the gland becomes smaller and firmer, but this is not always true. In most instances the thrills and bruits disappear. There is an increased sense of well being, the heart beat is slower, and there is less palpitation. There is some gain in weight and strength and a decrease in the stare and exophthalmos. Patients complain less of nervousness and insomnia. There is a decrease in the tremor and less sweating. There is less emotional disturbance.

PATHOLOGICAL PICTURE

Thiouracil causes an increased vascularity or at least an increased tendency to bleeding, and the glands in primary hyperthyroidism resemble those encountered before Lugol's solution was introduced. The use of the latter combined with thiouracil decreases the bleeding. The typical histological picture of primary hyperthyroidism is markedly altered, but unlike the tendency of hyperplasia reverting to colloid (as seen after Lugol's solution), only little colloid is seen. Occasional infolding areas of epithelium appear, but most of the acini are small and contracted with an increase in the interstitial tissue. The gross appearance of the glands in both

primary and secondary hyperthyroidism does not appear to be changed.

SURGICAL RESULTS

Following several weeks preparation with thiouracil, there occurs a marked reduction in the postoperative reaction of both forms of toxic goiter. There has been only slight elevation of the pulse, temperature, and blood pressure and but little nervous reaction in the cases on which I have operated. However, the addition of iodine in the preoperative preparation may also be a factor in the lessened reaction. Thiouracil has been given only for three days after operation, but the patients have been continued on iodine until the postoperative metabolic rates are normal. To date, the recovery of all our patients has been smooth and satisfactory.

CASE REPORTS

Case I. (113-573) A female, aged eighteen years, entered the Jackson Clinic on April 1, 1943, with a recurrent exophthalmic goiter and a bilateral adductor laryngeal paralysis. Because of the paralysis, iodine therapy rather than surgery was advised, and the patient's condition was controlled satisfactorily. In December, 1943, thiouracil 0.1 Gm. daily was substituted, and after a week the dosage was doubled. On January 20, 1944, the patient stated that she felt improved. Her heart did not beat so rapidly, and she was less nervous. The pulse rate was 128. Four weeks later she had lost seven pounds, and the basal metabolic rate had gone from +17 to +38 per cent although she felt better, slept better, and was less nervous. She stopped the drug for two months and then was given 0.1 Gm. three times daily. On August 2,1944, she felt better, the palpitation of the heart had improved, the basal metabolic rate was +21 per cent, and she had gained one and one-half pounds. On September 2, 1944, she had gained three pounds, the basal metabolic rate was +10 per cent, and the pulse rate was 78.

Case II. (122-186) A female, aged thirty years, with a severe case of iodine-fast exophthalmic goiter had been taking iodine for thirteen months before coming to the clinic. Her basal metabolic rate was +79 per cent, the pulse rate 108.

On June 6, 1944, the patient was given thiouracil 0.1 Gm. twice daily for one week and then three times daily. On June 29, 1944, she reported that she felt much better, less shaky and nervous. On July 10, 1944, she was much improved; her heart was slower, she slept better, there was less tremor, and she was stronger. The presence of a thrill and bruit in the superior thyroid pole was still noted. The patient had gained seven pounds and was continued on the above treatment. On July 24, 1944, she returned, reporting a gain of eight and one-half pounds in two weeks. The basal metabolic rate had dropped to +56 per cent. She felt generally improved. The thrill and bruit had gone. The thiouracil was increased to 0.3 Gm. and 5 drops of Lugol's solution was added. On August 14, 1944, the basal metabolic rate was +49 per cent, and thiouracil 0.4 Gm. was given. Two days later a primary thyroidectomy was done. There was very little reaction. On September 7, 1944, the basal metabolic rate was +2 per cent. She had gained fifteen pounds and felt very well.

Case III. A female, aged sixty-five years, whose case was diagnosed as a subtotal toxic adenoma of the thyroid had lost twenty pounds in the previous three months, was very feeble, and had marked tremor and dyspnea. The basal metabolic rate was +87 per cent, the pulse rate 108 and the weight 108 pounds. The blood pressure was 178 mm. systolic and 80 mm. diastolic. The quadriceps loss test was positive 3, on a scale of I to IV. She was considered a rather poor surgical risk.

On June 26, 1944, the patient was hospitalized and put on thiouracil 0.1 Gm. three times daily. On July 1, 1944, the basal metabolic rate was +59 per cent, the pulse rate 90 and the weight 106 pounds. Generally, the patient felt much improved and appeared to be considerably stronger. It was decided that a primary thyroidectomy could be done, and it was performed on July 5, 1944. The patient made an uneventful recovery, and the postoperative reaction appeared to be less severe than one would expect in such a case.

Two months later she reported she had gained sixteen pounds and was feeling fine. Her basal metabolic rate was +41 per cent; the pulse rate was 84. She was given thiouracil 0.4 Gm. daily. She followed this treatment for

two and one-half weeks but discontinued it for a few days because of looseness of stools. On October 21, 1944, the basal metabolic rate was +19 and the pulse rate 72. Thiouracil 0.3 Gm. daily was continued.

Case IV. (106-331) On June 19, 1940, I performed a thyroidectomy for exophthalmic goiter on a male, aged twenty-nine years. The patient made a good recovery. On October 26, 1940, he had mild symptoms of hypothyroidism. His basal metabolic rate was −22 per cent, his weight 142 pounds, and his pulse rate 55. He then assumed a strenuous war job in Detroit for three years.

On May 13, 1944, he returned with a recurrence of his goiter. The basal metabolic rate was +88 per cent, the pulse rate 90 and his weight 124 pounds. He was smoking one package of cigarettes a day, drinking coffee, and otherwise disregarding instructions. He was placed on Lugol's solution, 5 drops three times daily. On June 19, 1944, his basal metabolic rate was +55 per cent, his pulse rate 84 and his weight 133 pounds. He seemed generally improved and stated that he felt fine. At this time Lugol's solution was stopped and he was given thiouracil 0.1 Gm. daily. On July 10, 1944, he stated that he felt much better although he had lost five pounds in weight. The basal metabolic rate had gone up to +59 per cent; the pulse rate was 95. Thiouracil was then increased to 0.1 Gm. three times daily. On August 3, 1944, the basal metabolic rate was +72 per cent. He stated that he was feeling fine and had gained one and one-half pounds. Thiouracil was increased to 0.4 Gm. daily. Three weeks later the basal metabolic rate had dropped to +42 per cent, and he had gained six pounds. On Novemeber 2, 1944, he reported that he was feeling fine. His basal metabolic rate was −12 per cent, the pulse rate 61 and his weight 143½ pounds.

Case V. (121-884) A female, aged eighteen years, whose condition was diagnosed as a severe case of iodine-fast exophthalmic goiter had been taking Lugol's solution for two and one-half years before coming to the clinic. The basal metabolic rate was +72 per cent, the pulse rate 120 and the weight 146 pounds. She had a grade 4 enlargement of the gland and was considered to be a poor surgical risk. The blood pressure was 160 mm. systolic and 80 mm. diastolic. She was extremely toxic.

The patient was placed on thiouracil 0.1 Gm. twice daily. On June 13, 1944, this was increased to three times daily. At this time the basal metabolic rate had dropped to +45 per cent, the pulse rate was 108 and the weight was 143 pounds. On June 23, 1944, thiouracil was decreased to twice daily and the use of Lugol's was discontinued.

Cn July 5, 1944, the basal metabolic rate went up to +71 per cent, but she had gained 4 pounds in weight. She complained that her heart was very rapid and pounding and that she did not feel as well as when taking Lugol's. It was decided to resume the iodine but to continue on thiouracil 0.1 Gm. twice daily. The patient was hospitalized, and her blood pressure decreased to 138 mm. systolic and 75 mm. diastolic. During the next week the patient showed marked improvement. The basal metabolic rate dropped to +39 per cent. Although she again lost weight, the pulse rate remained at 116.

At this time it seemed advisable to do a first-stage thyroidectomy, and a sub-total resection of the right lobe and isthmus was performed. The gland proved to be extremely vascular and friable. There was very little postoperative reaction. The patient was out of bed on the third day.

Five weeks later a left lobectomy was performed with a moderate reaction. Seven weeks later she had gained sixteen pounds, but the basal metabolic rate was still +34 per cent and the pulse rate 108, so she was continued on Lugol's solution 5 drops three times daily. Clinically she appears well, but it may be advisable to drive this rate to normal with thiouracil.

Case VI. A female, aged thirty-six years, came to the clinic on November 12, 1943, with a recurrence of exophthalmic goiter. Thyroidectomy had been performed elsewhere in 1931. The basal metabolic rate was +54 per cent, the pulse rate 112.

On November 24, 1943, I performed a subtotal resection of the three lobes of the thyroid leaving only the usual fractional amount. Recovery was uneventful, but the basal metabolic rate never returned to normal, nor could the patient be considered entirely well. In five months she gained twenty pounds, but the basal metabolic rate was +29 per cent. She was continued on Lugol's solution for nine months, but because of influenza and

overwork she did not fully recover. On June 16, 1944, she was given thiouracil 0.1 Gm. plus 5 drops of Lugol's solution. Ten days later she had lost four pounds but felt better. Thiouracil was increased to 0.2 Gm. daily and Lugol's solution was stopped. The basal metabolic rate rose to +39 per cent by August 3, 1944, but three weeks later dropped to +11 per cent, and she felt much better. Thiouracil was increased to 0.4 Gm., and on September 7, 1944, the basal metabolic rate had dropped to +5 per cent, and she had gained eleven and one-half pounds. By October 6, 1944, she had gained another five pounds and was on a maintenance dose of 0.1 Gm. of thiouracil. To date this patient has shown the most satisfactory response to the drug.

Case VII. A female, aged fifty-two, was admitted October 13, 1944, with a diagnosis of multiple toxic adenoma and rather severe diabetes. The basal metabolic rate was +40 per cent. The patient had lost fourteen pounds in the two weeks prior to admission. This type of case, complicated by severe diabetes, is one in which thiouracil may greatly lower the risk of surgery and safely permit a one-stage operation. The patient was given thiouracil 0.4 Gm. daily and prepared by diet and insulin. A thyroidectomy was performed October 20, 1944, with but little reaction. The patient has made a very satisfactory recovery.

Case VIII. A female, aged forty-one, was admitted September 21, 1944, with a diagnosis of multiple toxic adenoma with secondary hypertension and chronic myocarditis. The basal metabolic rate was +66 per cent. Thiouracil 0.6 Gm. was given daily for ten days, and then 5 drops of Lugol's solution was added for five days. On October 3, 1944, the basal metabolic rate was +57 per cent, and although she had gained only two pounds, she felt considerably improved, was less nervous, and felt stronger. On October 11, 1944, a primary thyroidectomy was done; there was but slight reaction, and the recovery has been excellent.

Case IX. (124-564) A female, aged twelve, was referred by her physician, Dr. R. Roberts, with a diagnosis of exophthalmic goiter. Typical history and physical findings confirmed the diagnosis. The child was twenty-three pounds underweight. The basal metabolic rate was +31 per cent on October 6, 1944. She was hospitalized for a week on thiouracil 0.3 Gm. daily. She showed improvement, was less nervous, and slept better. Her heart was quieter, and on October 10, 1944, her basal metabolic rate had dropped to +20 per cent. She was sent home on the above dosage and returned November 1, 1944. Her basal metabolic rate was now +38 per cent (up 18 points). Her pulse was up 11 points, but she had gained four pounds. She is to continue on thiouracil 0.3 Gm. daily. Either the dosage is too small, or the drug is not effective in this child.

Case X. (123-459) A female, aged twenty, was admitted on August 16, 1944, with a severe case of partly iodine-fast exophthalmic goiter. She had received the drug for four weeks prior to admission when the basal metabolic rate was +41 per cent. She was given thiouracil 0.4 Gm daily, and on August 30, 1944, the basal metabolic rate was +28 per cent. But on September 23, 1944, the basal metabolic rate had gone up 15 points. There was no improvement, and the exophthalmus had increased. In addition to the thiouracil 10 drops of Lugol's solution was given three times daily. On September 23, 1944, the basal metabolic rate was down to +16 per cent, and a primary thyroidectomy was done with but little reaction. This case represents the delayed action of thiouracil due to iodine.

CONCLUSIONS

A report of thirty cases of hyperthyroidism treated with thiouracil is presented.

Sufficient time has not elapsed, and a sufficient number of cases has not been studied to warrant any definite conclusions about the permanent efficacy of this drug.

In view of the numerous complications arising from its use (including seven fatal cases of agranulocytosis in a series of approximately 2,000 cases) every safeguard should be used to protect the patient receiving the drug.

Because of the fact that approximately 83 per cent of the patients receiving thiouracil are benefited, its further investigation appears justified.

Six special indications for which the drug seems indicated are listed.

From a study of this small series of cases, it does not appear that thiouracil will supplant surgery in the treatment of exophthalmic goiter. In toxic adenoma it will not exclude thyroidectomy, but it may eliminate a two-stage operation.

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SURGICAL TREATMENT OF CANCER OF THE COLON AND RECTUM*

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FOR some reason the expression, "cancer of the rectum," is associated with a greater psychological reaction upon the part of the patient than is the diagnosis of cancer of the stomach. It is difficult to explain this reaction for the ultimate prognosis for a patient operated upon for carcinoma of the rectum is at the present time far superior to the prognosis that obtains after resection of the stomach for carcinoma. Perhaps the inevitable and visible colostomy with permanent loss of normal rectal evacuation is largely responsible for this state of mind.

It is a commonplace observation that innumerable patients suffer varying degrees of bowel discomfort with rectal bleeding rather than go to a doctor for surgical relief. Probably in no field of abdominal surgery has such rapid and satisfactory advances been made in diagnosis, operability, operative technic and ultimate cure as in neoplasms of the large bowel. There are certain general characteristics that apply to neoplasms of the large bowel, and it is upon these characteristics, both technically and anatomically, that there is such a wide choice of technical procedures. For reasons of clarity neoplasms of the large bowel including the rectum may be allocated to: (1) neoplasms that involve the cecum and the right side of the colon, (2) neoplasms that involve the left colon, from the midpoint of the transverse colon to the rectosigmoid, and (3) neoplasms involving the rectosigmoid and anus. One might employ a phrase, "a shift to the left," to indicate that with localization of a neoplasm from the cecum upward to the left and downward, there is a marked change in the surgical characteristics of the neoplasm. There is an increase in the intrinsic virulence of the cancer cell, an increased tendency for glandular metastases, an increase in the obstructive element of the tumor, and finally a radical change in the technical procedures for extirpation.

Neoplasms of the right colon tend to be broad, flat, ulcerous tumors, remaining local for an indefinite period, with a low biotic virulence, and with metastases relatively late. Owing to the large lumen of the cecum and ascending colon, together with the small amount of fibrous tissue elements in the neoplasm, there is very little tendency toward obstruction. This general picture is in contrast with a neoplasm of the sigmoid where the tendency to ulceration is less than on the right side, where there is a large amount of fibrous tissue elements in the neoplasm with the production of varied and varying degrees of obstruction, and where the cancer cell is more virulent and tends to metastasize more quickly into the lymph glands of the area.

The symptomatology also varies with the location of the tumor but there are three symptoms, either separately or combined, which are almost invariably present with all types and locations of neoplasms: (1) the presence of blood, either occult or frank; (2) pain, and (3) disturbance in bowel rhythm. With right-sided neoplasms, with their flat surface and large ulceration there is a continuous and progressive anemia. This anemia is a severe type of secondary anemia, and is the result of many factors: (1) The progressive character of the malignant ulceration causes a continuous loss of blood in varying

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amounts; (2) the absorption of cancer detritus, plus partially digested blood, acts as a hemolytic agent. A suspicion of cancer

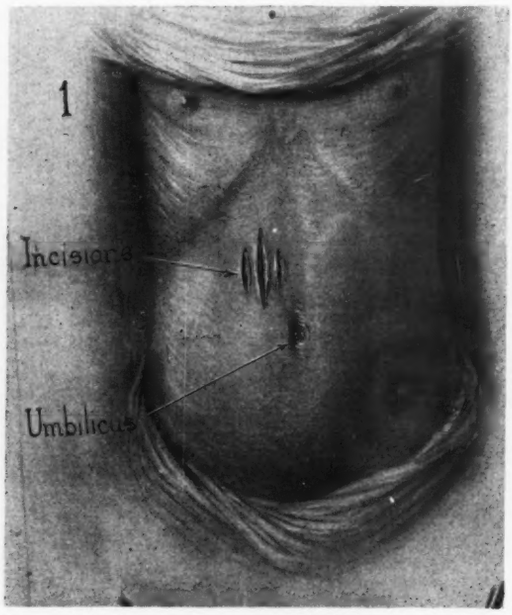

FIG. 1. Indicates the three incisions made in the right upper quadrant, far removed from the area of the cancer.

of the right colon may be entertained when a mature individual shows a pronounced anemia. This anemia sometimes is comparable to the clinical appearance of pernicious anemia. In general, only three other conditions must be excluded: carcinoma of the stomach, chronic nephritis and pernicious anemia. With a shift to the left in the localization of the tumor the obstructive and pain symptoms predominate and the anemia is not so apparent or noteworthy. It is not an infrequent occurrence for a surgeon to find a neoplasm of the sigmoid during the course of a laparotomy for a totally unrelated surgical condition such as an hysterectomy or cholecystectomy. A cancer of the cecum or ascending colon rarely causes in the early stages any marked interference with bowel function. With a cancer of the left and distal colon there is a tendency for some interference with bowel function and in many cases there is an intermittent constipation. The patient will volunteer the information that the cathartic pills that he has been in the habit of taking fail to move his bowels or if they do the movements are associated with a greater degree of cramps. It is rather interesting that about 10 per cent of people with a cecal carcinoma discover a lump in the right side before consulting a physician, and about 5 per cent of sigmoidal tumors enter the hospital with a complete intestinal obstruction as their first declarative symptom. Of outstanding significance in carcinoma of the rectosigmoid and rectum is the history of many, rather futile bowel movements, not in the nature of a diarrhea but urgent calls to the toilet to expel a quantity of gas and mucus mixed with blood. The patient will declare that he does not have a diarrhea but if you put the question: How many times do you go to the toilet to pass a small amount of feces with mucus and blood? the reply will be, "many times." Further evidence of this rectal urgency will be found in the fact that many of these patients have fecal stains on their underwear or wear a diaper or pad in their drawers to guard against "accidents." It is also worthy of note that about 20 per cent of people with carcinoma of the rectum have been either operated upon or treated for hemorrhoids.

If and when a patient observes blood, either incorporated with the stools or as frank blood in the bowl of the toilet, or on the toilet paper, it calls for a very definite determination of the source of the bleeding. Blood from hemorrhoids can usually be quickly determined by a proctoscopic examination and the visualization of normal colored stools above the proctoscope or in causing fresh bleeding from the manipulation of the instrument. Occasionally, a frank rectal hemorrhage may present a diagnostic problem of great magnitude. In December, 1941, a physician, fifty years of age, enjoying excellent health, one evening after dinner was seized with rather intense abdominal cramps. He went to the toilet and had a normal bowel movement and then within forty-eight hours began to have bloody stools, with a

fall in his erythrocytes to slightly over 2,000,000, and a hemoglobin of 40 per cent. *X*-ray studies of known competency could find no cause for the hemorrhage and proctoscopic examination was negative. The patient made a slow recovery back to a normal blood picture and a rather dubious diagnosis was made of intestinal varix. The patient has had no other attack of bleeding and has remained well. In contrast, a female, fifty years of age, consulted me in December, 1939, with the history of "passing blood by rectum for the past nine months." A diagnostic study was undertaken by her physician, Dr. A. A. Jaffe, of Jersey City, and a diagnosis of "polyp of the descending colon" was made. A sigmoidoscopic examination at this time was negative upon the introduction of the instrument to the extent of ten inches. The stools suggested a continuous seepage of blood rather than any frank hemorrhage. A second barium colon enema, about one month later, revealed moderate irritability of the colon, and probably a small isolated polyp of the sigmoid. For two to three weeks at a time the stools would be free of blood. The patient was again examined six months later and "notwithstanding the use of the double contrast method as well as compression, a definite interpretation of polyposis is not justifiable." The patient gained weight and apparently the bleeding by rectum diminished. However, in February, 1941, Dr. Jaffe was positive that there were two discrete polypi in the sigmoid. In view of all the negative *x*-ray examinations of the stomach, gallbladder, etc., it was assumed that these polypi were the cause of her hemorrhage. After a convass of the situation, on March 5, 1941, an exploratory sigmoidotomy was performed and two polypi were found, one approximately 3 cm. in length, and the other 2 cm. in length, and both located within 10 cm. of each other. Both polypi were excised, and the bases cauterized followed by a sigmoidorrhaphy with complete relief and cessation of bleeding.

In no other surgical condition of the large bowel is there so great an inherent tendency for a primary non-malignant lesion of the colon to become malignant as in polyposis. There is a strong family disposition to polyposis and numerous

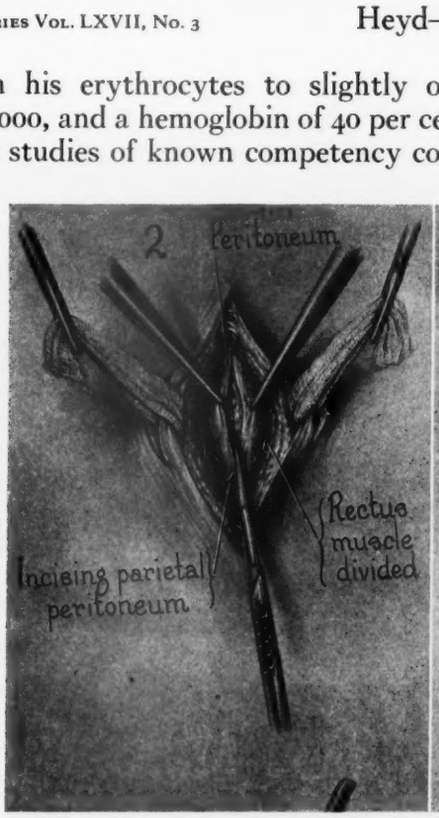

Fig. 2. The mechanism of preparation of the lateral orifices for the Devine colostomy.

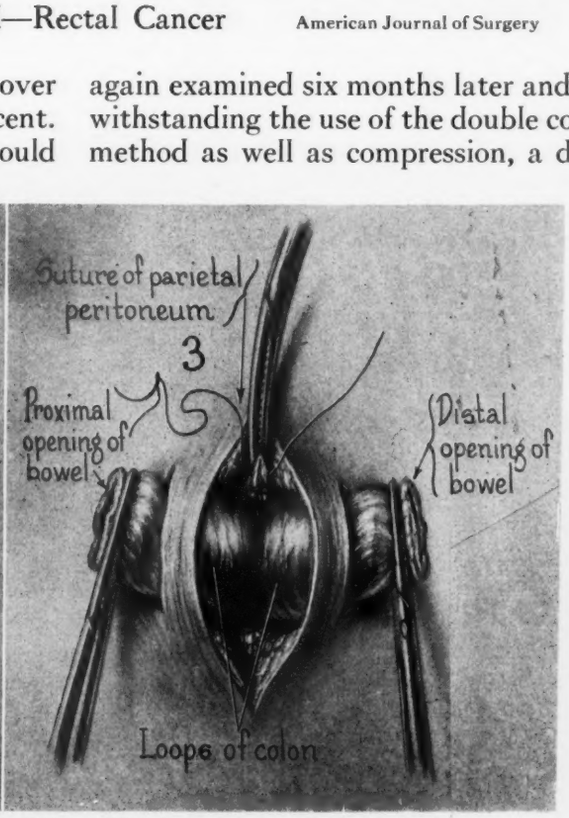

Fig. 3. The divergent loops of the Devine colostomy after being brought through the lateral incisions.

histological examinations of polypi removed at operation have showed independent cancer degeneration simultaneously in two or more polypi. The predisposition to cancer is well illustrated in the observations of Rankin which strongly emphasize the familial disposition to polypi and high incidence of malignant degeneration.

FIG. 4. The appearance of a Devine colostomy four days after operation. Note the wire suture and small piece of gauze at lower angle.

Occasionally, a polyp is detected in the upper rectum and there is a temptation to attempt its excision through the proctoscope in the doctor's office. This should be deprecated as the office facilities are many times not complete, and a hemorrhage following the excision in the office may be quite alarming and with the patient not anesthetized attempts at packing will be painful, incomplete and often nugatory. It is much safer to have the patient in the hospital and anesthetized.

The colon that is the site of a malignancy is one which has lost considerable of its normal tissue resistance as well as its reparative and recuperative power after operation. In a lesion so situated as to produce some element of obstruction, slight though it may be, there is a simultaneous hypertrophy of the bowel proximal to the lesion, with increasing distention and with retention or stasis of colonic contents. This proximal loop of bowel is essentially a living test tube teeming with highly virulent organisms. It is a bowel that does not lend itself to resection and particularly to primary end-to-end anastomosis. Leakage after an end-to-end anastomosis for an obstructive malignancy occurs not so much from the giving way of the suture line, *per se*, as leakage through the stitch holes, for a bowel proximal to an obstruction is to a large extent one that is lacking in viability and will frequently leak with a resulting peritonitis.

Certain broad surgical principles are inherent in any technical procedure for resection of a malignant tumor of the colon or rectum. They may be listed seriatim: (1) It is imperative to relieve all proximal bowel distention. The ordinary medical measures for decompression of the bowel are in the majority of cases quite satisfactory. Irrigations, salines by mouth, non-residue diet, rest in bed, application of external heat to the abdomen, will in many cases suffice. If, however, the giving of a saline cathartic is associated with an increase in abdominal pain, the patient should have an operative decompression before resection is attempted. (2) To restore the patient's general condition to as near the age norm as possible, the measure adopted consists of high caloric, high protein diet, forced fluid intake, preferably giving at least one intravenous infusion of normal saline plus 5 per cent dextrose daily. If a second infusion per day is given, I usually prefer 1,000 cc. distilled water plus 5 per cent dextrose. (3) Blood transfusions are of marvellous assistance in reconditioning the patient for surgery. The number and frequency will depend upon the clinical findings and certainly one transfusion of 500 cc. should be given during or immediately after the resection. A determination of serum protein before and after operation is a very valuable aid in estimating the degree and

possibility of a pre- and postoperative hypoproteinemia. (4) An adequate survey of the cardiorenal system. In short, the utilization of any and all measures to make the patient safe for surgery. The surgeon alone can determine what surgical technic, either singly or in stages, will be safe for the patient. (5) The preoperative and postoperative use of sulfa drugs and plasma.

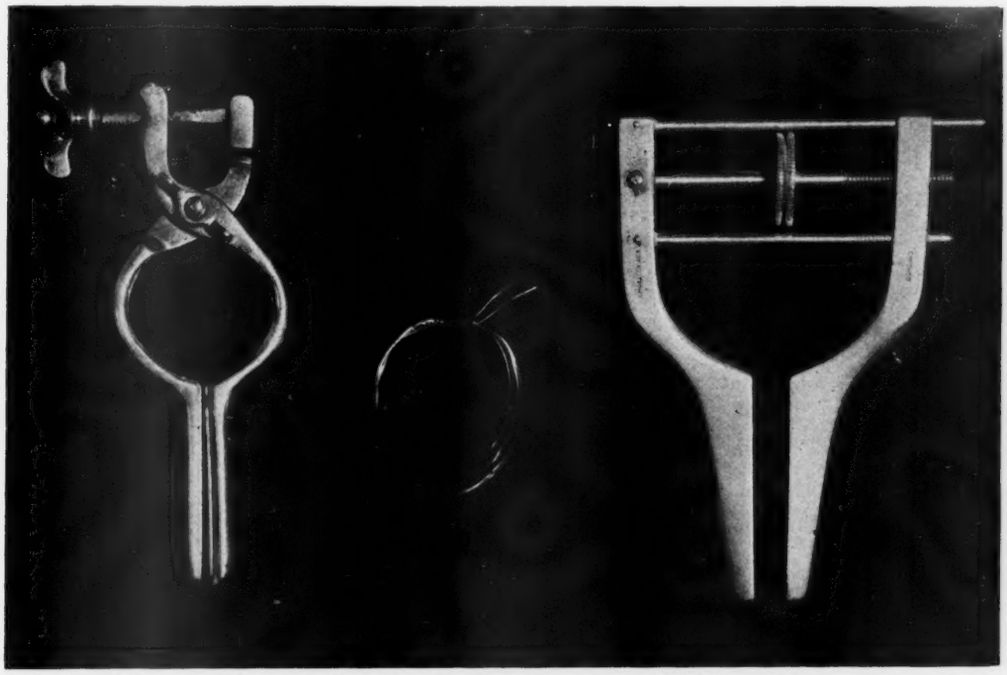

Fig. 5. At left the Devine spur clamp; in the middle, a sample of Malin stainless steel wire: at the right the Ochsner-deBakey-Devine spur clamp.

Cecostomy is seldom a satisfactory method to accomplish decompression. At the best it will relieve only the gaseous distention proximal to the obstruction but it will not completely deflect the fecal current. It does not diminish the virulence of the intestinal contents and technically it does not function well in fully half the cases in which it is performed.

We are convinced that practically all tumors on the left side of the colon can be rendered safe for any technical procedure, with a low mortality, and a rapid convalescence if the Devine colostomy is employed. The Devine colostomy, as a preliminary operation for a resection of the colon or the anus, is one of the most significant contributions to colon surgery. It is performed through a right upper quadrant incision and on that portion of the transverse colon between the hepatic flexure and the mid-point of the transverse colon. It allows complete intra-abdominal exploration, and is easily performed. The patient can take care of it with a minimum degree of trouble.

An incision approximately 7 to 10 cm. in length is made about 3 cm. from the mid-line in the right upper quadrant and about halfway between the ensiform and the navel. The peritoneal cavity is opened and the gloved hand smeared with sterile vaseline is introduced and an abdominal exploration carried out. Exact information is acquired as to the location of the growth, the associated bowel inflammation, the occurrence of metastatic glandular invasion, the condition of the cul-de-sac of Douglas, the presence or absence of metastases in the liver, and the general condition of the large bowel proximal to the obstruction. The right half of the transverse colon is mobilized and delivered through the incision. A tape is passed

beneath the bowel and the gastrocolic omentum and the great omentum are dissected free so as to permit the approximation of the inferior white band on both loops for a distance not less than 12 cm. and up to a point about two inches below the tape. In this manner the "double-barrel" portion of the colon suspended on the tape comes through the abdominal incision freely and easily. On each side at approximately the middle point of the abdominal incision, but about 3 cm. to the right and left of the incision, a stab wound through skin and subcutaneous fat is made no longer than 2 or 3 cm. The colon loop is held in the mid-portion of the original incision and the peritoneal cavity closed rather snugly about it but no sutures are placed into the bowel wall. Two crushing clamps are then introduced, one from each side, through the stab wounds and placed close together on the bowel. The gut is then divided between the clamps with the cautery. The free loops of the right and left portions of the transverse colon are then brought out respectively through the right and left lateral stab wounds and held in place without suture by the occlusion clamp. The abdominal wound is then closed with michel clips and a short latex drain is inserted in the lower angle. It is of great importance that the skin of the stab wound fit very snugly around the bowel without sutures as the desired end result is that the colostomy orifices of both bowel ends when finally healed shall have a diameter not greater than 1½ cm. When the proximal colostomy orifice is small, free exit is provided for the soft contents of the ascending colon and cecum, yet there will be sufficient impediment to uncontrolled discharge as to permit most of the fluid being retained by the patient. No fear need be entertained of any ob-

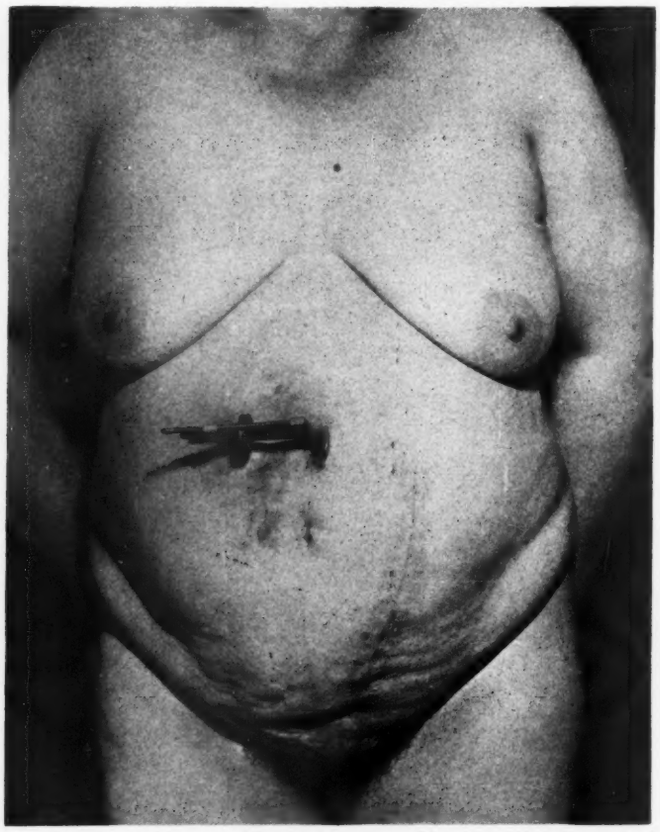

FIG. 6. The reconstruction of colonic continuity with the special spur clamp; patient up and about the ward.

structive symptoms as the soft contents of the cecum and ascending colon will be readily evacuated.

The following advantages are obtained with this technic: (1) An absolute and complete separation of the fecal current from the proximal to distal loops; (2) complete decompression of the obstructed loop; (3) the ability to render less septic the obstructed loop by bowel irrigations of mild antiseptics and the introduction of aqueous solutions of the sulfa drugs. In the course of two or three weeks an obstructed loop will have resumed its normal tone, the inflammatory changes in and about the tumor will have subsided, the tumor itself will have shrunk, and the contents of the bowel will be of a low attenuated virulence. (4) The patient will have one, at most not more than two, bowel movements a day from the colostomy. The stool will be of a soft homogenous consistency and readily controlled without any bag or container. A Trask colostomy "hat" will provide a safe firm dressing and control. (5) The re-establishment of bowel continuity is readily performed later, after the resection by the special Devine spur crushing clamp. This stage requires only from three to four days in the hospital. If leakage occurs at the site of the resection of the neoplasm, it can be allowed to heal by granulation without any further surgery as the present of the Devine colostomy prevents any contamination about the area of the resection with stool. (6) The closure of the abdominal orifices of the Devine colostomy does not require any further surgery. By cauterization of the mucous membrane with the actual cautery the orifices gradually close in by themselves.

By utilizing the preliminary Devine colostomy procedure it is possible after three or four weeks to resect any tumor on the left side even into the upper portion of the rectum, and to perform an end-to-end anastomosis with the reasonable expectation that the bowel union will heal per primam, and without leakage. The greatest value, however, of the Devine colostomy is in a patient in whom the tumor on abdominal exploration made at the time of the colostomy seemed to be inoperable, but which in the course of three or four weeks after the colostomy when freed of the continuous irritation and contamination of the stool shows almost complete resolution of the surrounding inflammation and to have become capable of resection. If any one feature of the Devine colostomy warranted its place in the technical resources of the surgeon, it is the increased ability to resect tumors of the left colon that on first palpation seemed beyond surgical resection. Furthermore, so significant is the resolution of the inflammation surrounding a low rectosigmoidal growth, together with the shrinking of the tumor and its increased mobility four weeks after a Devine colostomy, that it is possible to do a low rectosigmoid resection instead of an abdominal perineal resection.

I am prepared in view of my experience with the Devine colostomy to go even further and state that it is in my opinion the best mechanism for treating perforating diverticulitis. Assuming that most cases of perforating diverticulitis will, if competently watched, resolve and recover without surgical intervention, there are still some cases which will perforate and if the diverticulitis is attacked directly the result can only be an incomplete operation of drainage, or a formidable operation of resection, with a low colostomy and a high operative mortality. A preliminary Devine colostomy is readily tolerated by the patient, assures complete intestinal rest to the sigmoid, and will permit at a later date if necessary an operation without a prohibitive mortality.

CASE REPORT

A male, age sixty-three, entered a hospital in a nearby town, with a complete intestinal obstruction due to a rectal mass diagnosed as inoperable carcinoma of the rectum. A colostomy was recommended, together with *x*-ray

therapy. The patient was brought to New York and entered the Post-Graduate Hospital. The rectal obstruction was so complete that a barium colon enema could not be introduced. The patient's history was characterized by three significant features: (1) intermittent pain in the left lower quadrant, (2) bladder irritability with painful micturition and (3) an absence of blood in the stools. On examination the patient had a mass in the left lower quadrant. On rectal examination there was complete obstruction from a large, tender pelvic mass. There was no rectal bleeding upon examination. A preoperative diagnosis of perforating diverticulitis of the sigmoid was made.

The operation consisted of a Devine colostomy through the right upper rectus muscle. On opening the abdomen a complete exploration was carried out, with the following findings: The descending colon passed down unimpeded into the sigmoid where an infiltrating process involved the entire wall of the bowel and extended from the sigmoid to the junction of the rectum proper. There was a marked inflammatory reaction surrounding the mass so that it was fixed to the lateral and posterior wall of the true pelvis. The small intestines seemed to be normal. The liver was without any palpable or visible evidence of metastases.

The patient left the hospital fifteen days after the Devine colostomy was performed. Two months later a barium colon enema from below upward to the left upper colostomy opening did not show any *x*-ray evidence of obstruction. The beginning of the sigmoid for a distance of 8 cm. showed irregularity and small pocket-like diverticula. *X*-ray examination from above downward through the left upper colostomy opening did not show the presence of any obstruction. Three and a half months from the time of the Devine colostomy an Ochsner-De Bakey spur clamp was applied and bowel continuity re-established. One month later the right colostomy wound closed spontaneously and a few weeks later the left colostomy opening was closed after two cauterizations of the mucous membrane and granulation tissue.

This case illustrates the application of the Devine colostomy for the relief of intestinal (colon) obstruction. A further advantage is based upon the fact that the fecal contents of the right colon are completely "side-tracked" from the left colon and at the same time preparations were made for any subsequent surgery that might become necessary. It is the underlying philosophy of the Devine colostomy that seems to me most important. At the present time, it is the only procedure performed remotely from the field of pathology that can give much manifest benefits and simultaneously prepare the patient for a successful approach to the initial lesion at a later time with a low mortality.

I would like to bring to your attention the use of stainless steel wire for closure of the abdominal wall after colon surgery. Its usefulness was demonstrated by Dr. Tom Jones at the Crile Clinic in the closure of the abdominal wound after an abdominoperineal resection. The abdominal parieties are closed by through-and-through interrupted sutures of Malin stainless steel wire. The wire ties almost as readily as linen, and is usually well tolerated by the tissues. It promotes a firm abdominal closure without infection. The presence of catgut or linen in an abdominal wound, through which a resection has been performed, is many times infected regardless of the technic employed, and the peritonitis that occurs a week after a resection is often times due to a breaking into the peritoneal cavity of an infectious process of the abdominal wall. Since we began to use steel wire our wound infections have been remarkably reduced. At the present time, I personally employ the Devine colostomy as a preliminary measure before an abdominoperineal resection of the rectum for carcinoma. The colostomy is far removed from the operative field. After two weeks, the bowel function through the Devine colostomy will be regular and normal. The left colon and rectum will be rendered as nearly aseptic as possible by the treatment outlined above. The inflammatory changes incident to the tumor will have subsided and the abdominoperineal resection can be more easily performed with less mortality than

usually attends this severe operation. To do a two-stage abdominoperineal resection and have the permanent end colostomy in or about your operative wound at the second stage is not only prejudicial to its sterility, but in addition the adhesions that one sometimes encounters nullifies at the second operation the effectiveness of the two-stage procedure in that at the second stage so much time has to be consumed in separating the adhesions of the previous operation. With a previous Devine colostomy none of these hazards or embarrassments are present.

There is another benefit in employing a Devine colostomy as a preliminary to an abdominoperineal resection and that is the improvement of the patient's morale after the colostomy. The rectal tenesmus is terminated. The appetite improves. The pain largely disappears and the patient's sense of well being is remarkably enhanced. Psychologically he approaches the second operation with a much better frame of mind. The improvement has largely conquered his fear and anxiety.

In a resection of the cecum or ascending colon, it is our practice to blind the terminal ileum and the proximal end of the transverse colon and do a typical lateral anastomosis. Somewhat proximal to the anastomotic opening a stab wound is made in the large bowel and a female pattern self-retaining catheter inserted, using the technic of Witzel as applied in a Witzel gastrostomy. The catheter stem is brought out through the separate stab wound and very effectively maintains decompression of the large bowel. If and when the purpose of the catheter colostomy has been fulfilled, the stem of the catheter is pulled somewhat taut and then cut off close to the skin. In the course of a few days or a week the ballooned tip of the catheter will be passed by rectum. This little procedure allows the removal of the tube without the trauma that must ensue if it is dragged out of the bowel through the abdominal wall.

The increasing usefulness of the Devine colostomy may also be emphasized by the fact that it offers by all odds the best permanent colostomy. If the functional utility of the colostomy is to be gauged by the criteria I have indicated, the Devine colostomy meets all these conditions. An additional indication for its employment would be in the treatment of the anorectal syndrome of lymphogranuloma venereum.

Up to date the Devine colostomy has been utilized in thirty personal cases. There were no mortalities following this technic. The indications were partitioned as follows:

1. As a preliminary to abdominal perineal resection	10
2. As a preliminary to resection of the rectosigmoid	4
3. As a preliminary to resection of the sigmoid	5
4. As a preliminary for the treatment of diverticular tumor	4
5. As a permament colostomy for ulcerative colitis.	4
6. As a temporary procedure for anastomotic leakage after resection of the left colon	1
7. As a temporary procedure in sigmoidal vesical fistula	1
8. As a permanent colostomy in destruction of the rectum due to lymphogranuloma venereum	1
Total	30

CONCLUSIONS

1. The Devine colostomy extends the indications and resectability for cancer of the left colon, rectosigmoid and rectum.

2. It is the most efficient temporary or permanent colostomy.

3. It is technically easy to perform.

4. It is without mortality *per se.*

5. Colon continuity may be re-established at any time by a simple procedure with a special clamp.

6. It is a fundamental contribution to surgery of the colon.

IMPROVED BREAST LIFTING OPERATION

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NEW YORK, NEW YORK

THE surgical correction of pendulous breasts has received comparatively little attention by the general surgeon. Aside from breast amputation for cancer, an operation for reduction in size and restoration to the normal position has been avoided. Even those who specialize in plastic surgery, who employ a great variety of methods, evidence a need for a standard procedure by which successful results may be reasonably assured. My attention was first directed to this type of surgery after I had witnessed the result of operations by various corrective measures as employed by other surgeons, and came to the conclusion that there was plenty of room for improvement. The improved method which I now use, and have used successfully in a number of cases, appears to have each step following the previous one in logical sequence, and the instruments which I have devised enables one to perform the operation quickly and without guesswork, and the results more nearly approach the normal, in that successful functional and cosmetic results are more certain of attainment.

It is not necessary to go into detail as to why a woman having enlarged and pendulous breasts desires to have these reduced in size and restored to their normal position on the chest wall. I shall simply try to describe the details of the operation as modified by me and the how and why the instruments which were devised by me can be used to produce a result which will please the patient as well as the surgeon performing the operation.

Measurements taken of the position of thousands of normal breasts show that the average position of the nipples is four and one-half inches from the midline, and opposite the third and four costal interspace. The nipples are nine inches apart, one at each angle of the base of a triangle with the apex at the supraclavicular notch. With these measurements in mind, I had a triangle constructed of German silver, with a sort of button embedded in the apex, the undersurface projecting a slight distance. When this is placed in the sternal notch and allowed to rest on the chest, it will be found that each nipple is seven to eight inches from the apex of the triangle, and nine inches apart. Use is made of this triangle prior to the operation to indicate approximately where the nipples should be, and during the operation while suturing to make one confident that the nipples have been relocated correctly. (Fig. 5.) When performing the operation, it is entirely unnecessary to make elaborate measurements showing where the nipple should be located, as described by previous authors. The triangle which I have devised does this quite accurately, and eliminates the possibility of a mistake. Some articles describe a method in which a buttonhole incision is made at the time of the operation so placed that when the breast is placed in position it will protrude through this button hole. The operation as now performed eliminates this step completely.

The primary incision is usually made by the majority of operators underneath the breast, running horizontally in a curvilinear fashion extending the full length of the breast even out into the axillae. This method of operating has been abandoned because the ends of the incision may be visible when wearing an evening gown or a slim bathing suit. The cut as now made extends only from the nipple to the chest wall in a verticle direction. Thus the scar will be hidden by the bathing suit and evening gown, and the incision gives the surgeon more freedom of approach

than when placed in any other position. (Fig. 10.)

It is my custom when preparing these patients for their operation to advise them to have one or two Dierker colonic irrigations. This helps rid the system of impurities and makes the convalescence less complicated. The patient should take a good hot tub bath, on the night preceding the operation as tub bathing is impossible for a number of days while the incisions are healing. Nembutal gr. 1½ may be prescribed for a pleasant sleep in the case of apprehensive patients. About one hour before the operation a hypodermic is given of H.M.C. Mixture No. 1. This is a combination of morphin, hyoscine and cactoid, a heart stimulant. I have used this for many years and find it very satisfactory. I have also used Evipal, and pentothal sodium as a preliminary sedative measure. These operations are now performed in

Fig. 1. Fig. 2.

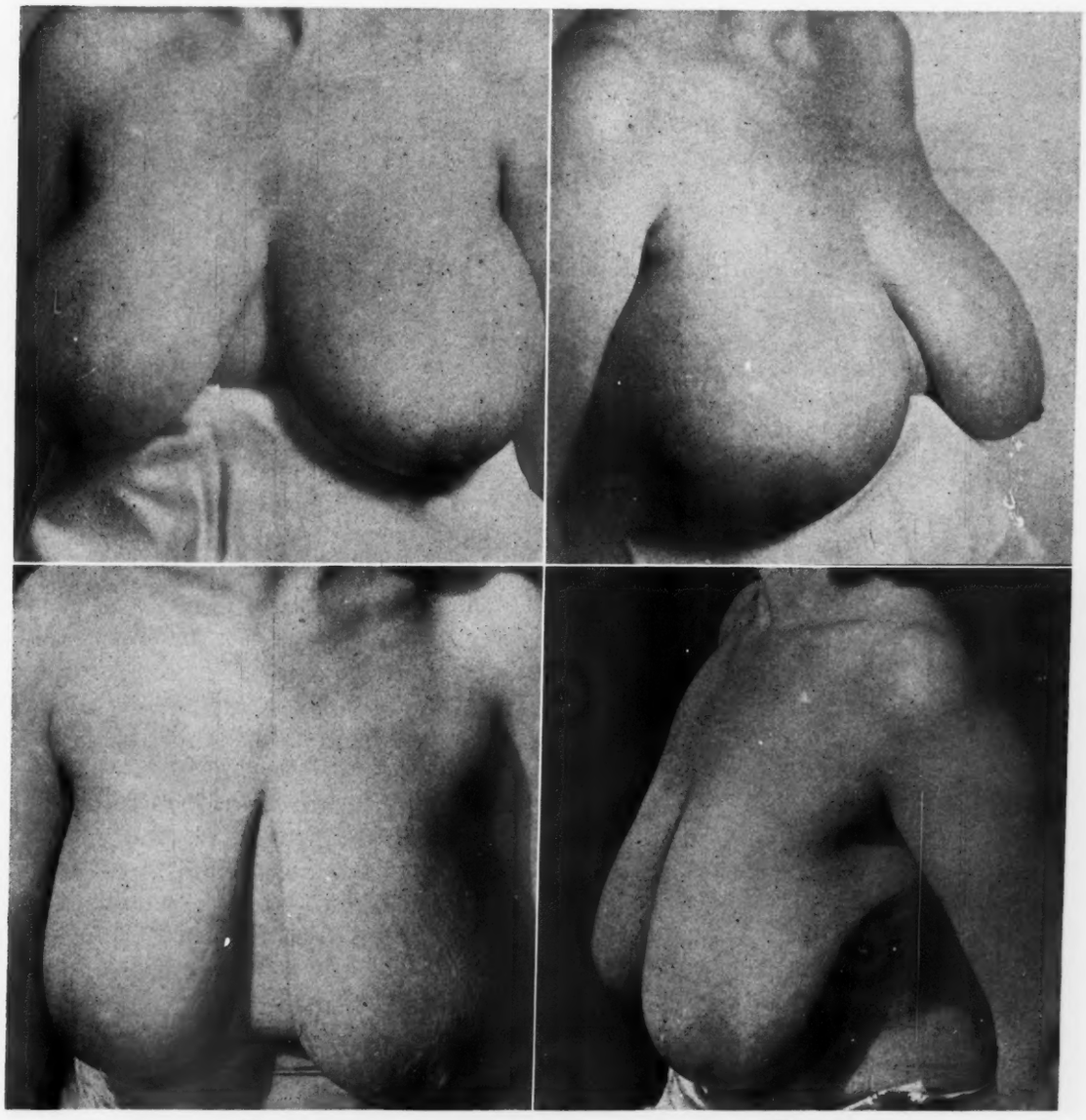


Fig. 3. Fig. 4.

Figs. 1 to 4. Pendulous breasts of all sizes and shapes are a constant source of annoyance to the wearer not only physically but also mentally.

practically every case under local anesthesia. By employing the modified, simplified, operative technic, nerve block of the outer region of the mammary gland it gives off a branch which supplies the outer one-half of the breast tissue, the

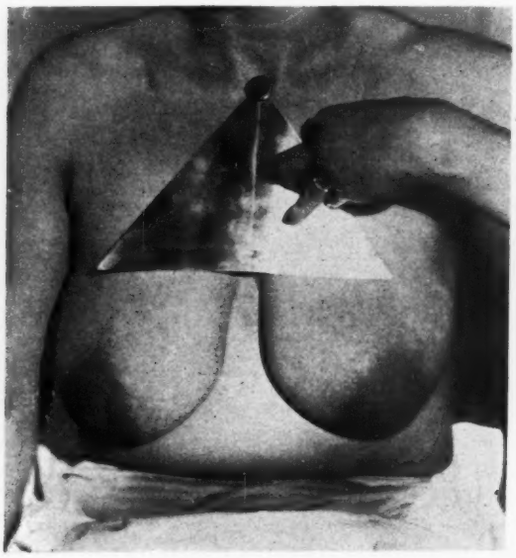


Fig. 5. Triangle suspended from the supraclavicular notch which shows approximately where the nipple should be normally located. By bunching the breast up in the palm of the hand, the correct location of the upper border of the areola of the nipple can be located and marked on the skin. The mark can be made with brilliant green, or better, by injecting a few minims of novocaine, a slight horizontal cut can be made which is not removed when later the antiseptic is applied. It is my custom to make this mark in the office a day or so prior to the date of operation. Everything is done to make the actual operating time as short as possible.

Fig. 6. Supporting ring is placed around the nipple with it in the center. The assistant by using slight pressure will cause the tiny pins on the undersurface to become embedded in the skin and thus keep it from slipping while the circular incision is being made.

anesthesia is very satisfactory, and allows the surgeon to concentrate on the various steps of the operation.

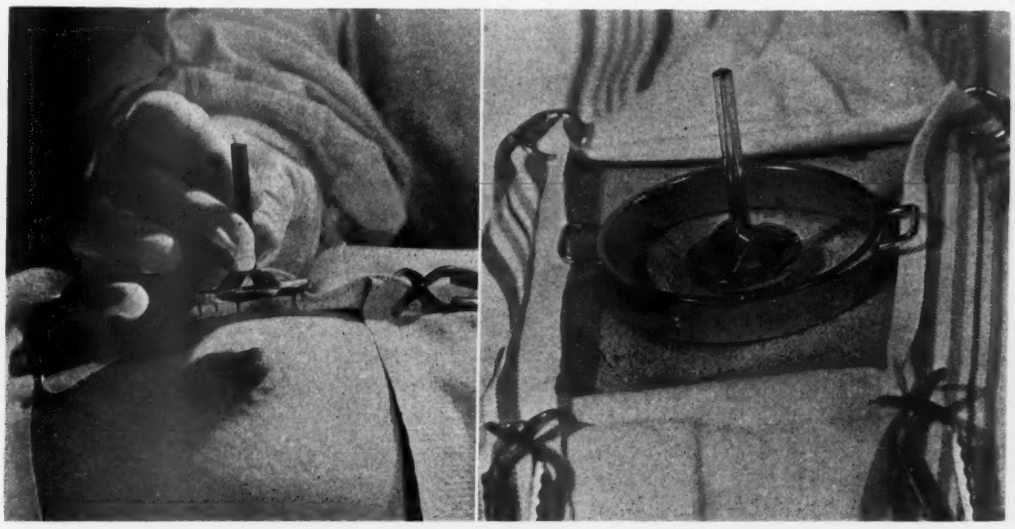
When the patient is placed on the operating table, the entire chest is painted with a tincture of Ceepryn 1-200. This gives perfect antisepsis which is very necessary in these cases.

Sensation in the mammary area is supplied by the third, fourth and fifth spinal nerves which occupy a notch in the posterior and undersurface of each rib. The artery and vein, which accompany the nerve, are situated in the same notch, but in a higher position. The nerve being lowest is more easily accessible. When the intercostal nerve reaches the region main nerve trunk continuing along the border of the rib to supply the inner half of the same gland. The procedure for blocking this nerve is as follows: About in the region of the midaxillary line, the needle is inserted hugging the lower border of the rib. The needle is pointed in and slightly upward, until the posterior surface of the rib has been reached. In this area about 2 cc. of 2 per cent procaine is injected slowly. The same procedure is adopted for each of the third, fourth and fifth ribs, the entire injection for all three not requiring more than one minute.

When properly injected, the anesthesia should be complete, but if it is not entirely successful, it will only take a few moments to inject locally around the nipple and in the neighborhood a few cc. of ½ of 1 per cent procaine with about 15 to 20 drops of adrenalin to the oz. This can be injected in every case, as it helps diminish the bleeding to a marked extent.

The first step in performing the operating is to cut a circle around the areola, using

the nipple as a center. The radio knife compass, which I perfected many years ago, is still the easiest and quickest to use.



A B

FIG. 7. A AND B, washer with pins on its undersurface, and with a bridge over the nipple supporting a vertical pin is placed directly over the nipple, the pins becoming embedded in the skin and thus supporting it, while the cut is being made.

But in the last few years, I have modified it quite considerably. The original one could make a circle of only a definite diameter. This was a handicap, as cosmetically the circle should be much larger in some cases than in others; and in several men who have had this operation performed it was impossible for me to use the compass at all as the areola was not much bigger than a dime. Formerly, the base of the center rod would rest on the nipple, and this was found to have a tendency to slip in all directions. To remedy these defects, a horizontal sliding bar was constructed to be attached to the vertical support of the compass, and to it another sliding attachment was added which could be held in any desired position with a screw. The sliding attachment was firmly fixed to the part that held the cutting electrode, so that the diameter of the circle could be made any width desired and locked in position. The end of the horizontal rod also serves as a handle when rotating the cutting point while cutting the circle. To prevent the vertical rod from slipping to one side or other of the nipple, a circular washer was constructed of such a size as would just fit around a large nipple. On the undersurface of this washer, six pins were attached, which would penetrate the skin by pressure and prevent slipping. Across the top of this washer a bridge was constructed, covering over the nipple, and from the bridge in a vertical direction a small rod was attached, about 1½ inches long which could be inserted into the hollow end of the vertical part of the compass. When the compass with its base attached was placed over the nipple and slight pressure made, all slipping of the compass is prevented. (Figs. 6 and 7.)

Another difficulty was formerly encountered in making the circular cut perfect, due to the fact that when the assistant supported the skin with the outstretched fingers around the nipple while the cut was being made, there was a tendency to pull more in one direction than in the other, with the result that in some cases the circular incision became irregularly oval. To overcome this I had about one-half inch of a large brass pipe sawed off to form a ring. On the undersurface of this ring, a series of fine pointed pins were embedded, and on opposite sides a flange was attached which would

enable the assistant to hold it firmly on the skin. In this way the skin was held immovable all around the nipple, presenting a solid flat surface for the cutting procedure.

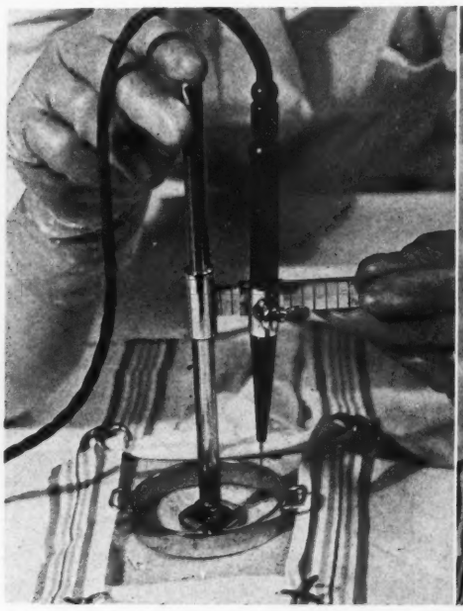


Fig. 8. The compass is adjustable so that the cutting point, which may be either a Bard-Parker knife or from an electrosurgical unit, is set according to the width desired, usually the same as the present areola. This is placed directly over the pin on the washer resting on the nipple, firm pressure is made with one hand on the vertical pin, while with the other the circular cut is made with one complete sweep, just through the skin and completely around the nipple. The whole procedure takes less than five seconds. Immediately following the circular incision the entire apparatus is removed.

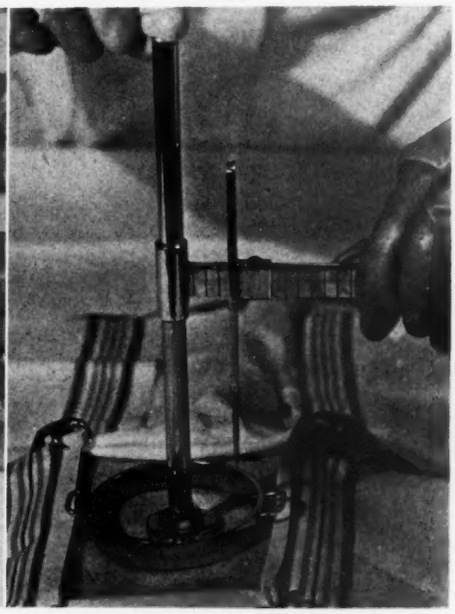


Fig. 9. The same as in Figure 8 showing the use of a Bard-Parker knife.

In cases in which one would prefer using the Bard Parker knife in preference to the cutting current, I had a handle constructed somewhat like the regular Bard Parker handle with a slot through the middle. This could slide on the horizontal bar and be locked in a set position just as the cutting electrode was fastened, and used in exactly the same way. My preference is for the cutting current, as it is more smooth in operation, much easier to manipulate, and the final result is just as good.

Operative Procedure. Place the large ring around the nipple with it as its center. Have assistant press it firmly against the skin. Place the little washer over the nipple and insert the pin in the end of the compass. Grasp the horizontal handle, press on the foot switch, and with one sweep cut a complete circle through the skin. This is done faster than you can say it. Remove the ring and the compass and with a knife or cutting electrode make a second cut from the lower border of the incision around the nipple directly downward to the chest wall. The length of this incision depends entirely upon the length of the undersurface of the breast. You do not need to be too careful to center this, as the edges are all removed when closing up.

The skin is now denuded from the entire surface of the breast. A Bard Parker knife, Cayor scissors, or any instrument you are familiar with may be used. Care must be used not to puncture the skin and to follow the lines of cleavage. This can be done with practically no bleeding, which is helped perhaps by the presence of the adrenalin and the procaine infiltrating the area. When the skin has been separated completely in all directions, three Lahey

goiter clamps are used to pick up the gland and hold it vertically upward. You now have the gland covered more or less profusely with fat, and the nipple uppermost surrounded by a very much contracted and irregular disc of skin. So far the breast has not been harmed in any way, all the blood vessels and ducts being intact.

The fat may now be removed. While the assistant elevates the breast, being extremely careful not to make any traction on the nipple, the surface fat is sliced off, downward and outward, from the Lahey clamps in all directions. You will now notice that the breast is composed of three parts: First, the base; this seems firmly attached to the chest wall and extends upward in the form of a sort of narrow pedicle, and above this the breast itself, with the nipple and areola resting on the uppersurface. When the breast tissue is greatly oversized, a keystone-shaped section is excised from upper central portion. The tissue is removed clean down to the pectoralis fascia, also other sections may be removed in a radiating direction from the lower portion of breast and edges approximated with chromic catgut. The main arterial supply follows the border of the pectoralis minor muscle and when this artery is severed, the result may be a necrosis of the upper and outer quadrant of the nipple, and therefore should be avoided. Small blood vessels penetrate the intercostal spaces at the border of the sternum and thus supply the mid-portion of the breast. This area should be avoided.

To shorten the pedicle, all that one has to do is to allow the outer part or body of the gland to be superimposed upon its base in its original position, and sutured by means of about six No. 1 20-day chromic catgut sutures. These sutures are placed above and at intervals around the circumference of the base. The Singer sewing machine surgical needle is well adapted for the insertion of these sutures, in which case fine silk may be used.

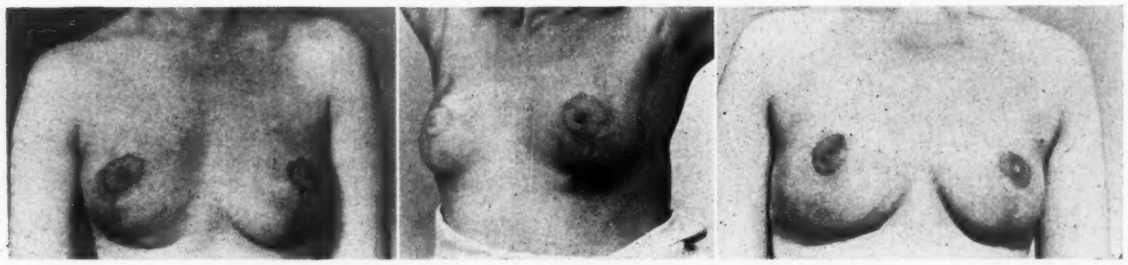
You now have the mammary gland resting on its original bed and sutured firmly in its proper position. It remains necessary only to fit the skin snugly around the reduced glandular tissue. The skin

Fig. 10. Vertical cut is then made downward, from the lower border of the circular incision around the nipple, in the mid-clavicular line. The incision extends downward to approximately the lower border of the breast attachment to the chestwall. The incision may be made with the Bard-Parker knife or the cutting point of the electrosurgical unit as desired.

has accumulated in varying quantities and lies in folds. To eliminate this correctly and in just the right amount is another problem. This was solved by the construction of a two-bladed clamp. Each blade has a slot in it which runs almost its entire length. The ends are held together by a screw with a winged nut, one end of which has a slot so that the blades can be widly separated if desired. With the fingers the loose skin is pulled over the breast on both sides as near to the center of the breast as possible and held by the Lahey or Allis clamps. The slotted clamp is now placed around and under them and locked loosely in position.

By manipulation and pulling up and outward on the skin edges, the skin can be made to be quite smooth on both sides of the clamp, with the tension approxi-

mately equal on either side. By pulling the skin in a downward direction, the length of the cut can be materially shortened. When this point has been reached, cision, a small drain may be inserted, although it is not necessary. Sulfanilamide is dusted over the entire incised area and a dressing applied.



A B C

FIG. 11. A, B and C, postoperative views of three patients.

the suturing begins. A straight or curved needle may be used with medium heavy silk. It is passed back and forth through the slot in the clamp, so as to form a horizontal mattress suture. Five or six of these may be needed, depending upon the individual breast. No attention is paid to the nipple and areola whatsoever, as it will now be buried beneath the skin. When the sutures have been completely inserted, by the aid of a knife or pair of scissors, the excess skin lying external to the clamp is sliced off, leaving the edges held together in close approximation by the mattress sutures previously inserted.

The final step is to bring the nipple to the surface. Here again we resort to the knife compass. By placing the cutting point about one inch below the upper end of the sewed up incision, the opening slightly larger than the original areolar incision is made. Following this cutting operation, the nipple will be found to emerge directly through this opening and in its correct position. Fine silk sutures are used, individually inserted, one at twelve o'clock, one at six, one at three and one at nine, etc., and so until the areola is circular and properly attached. The cut edges above the mattress sutures can be more evenly approximated by a running light silk suture running the entire length downward. At the lower end of the in-

It is quite essential that proper pressure be applied to hold the skin in direct apposition, to have the pressure evenly distributed in all directions, and thus avoid serum exudation. I have found nothing better than the rubber bags as advocated in one of my previous articles on this same subject. The bags used are the same as are made for the Barnes blood pressure outfit. These are placed upon the surface of the dressings and above this the bandages. The inlet and outlet tubes protrude below the bandage. When those are concted with the blood pressure outfit, and the pressure raised to about 10 to 12 mm. of mercury, the breast will be supported by a cushion of air with the pressure the same in all directions, and the dressing will be found to be very comfortable. For the first day, instead of air, the bag may be filled with ice water under pressure, and changed in several hours; on the next day warm water may be applied in the same manner, or the air pressure idea substituted for the ice water after the first twenty-four hours, one tube on one side being connected with a tube on the opposite side. While the healing is taking place the patient should be quite careful to rest quietly, and not remove the supporting measures for the gland. Downward pressure will cause the incision to widen and thus make the resulting scar more conspicuous.

RESECTION OF THE STOMACH*

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IN this paper we wish to discuss our present-day procedures in the selection, preparation, operation and postoperative care of patients having lesions that require resection of the stomach.

As one's experience increases with the years, one notes that the frequency of surgery in duodenal ulcer has distinctly diminished in direct proportion to the opportunity that these patients have for good medical management. In common, now, with other surgeons and gastroenterologists, we find that the great majority (85 to 90 per cent) of all our duodenal ulcers can be handled medically. When complications occur in duodenal ulcers, however, surgery is very definitely indicated, and it is our belief that at times we are *over-cautious* in recommending surgery in certain of these cases.

MANAGEMENT OF GASTRIC RESECTIONS

Of course, in acute perforation of a duodenal ulcer, every one agrees that immediate surgery is indicated, and we believe that in these cases our first concern is the prevention of a spreading peritonitis and not primarily the treatment of a duodenal ulcer. Therefore, we do nothing more than close the ulcer, and if at a later date further ulcer symptoms develop, or if pyloric obstruction occurs, it is then the proper time to consider whether further surgery is indicated.

In marked fibrous pyloric obstruction from a long-standing duodenal ulcer, we believe that surgery is indicated. In the past we were of the opinion that posterior gastro-enterostomy or gastroduodenostomy might well be used in these people, and not infrequently we still use these procedures. If the patient is old and feeble, we have found from careful follow-up studies that gastroduodenostomy for fibrous obstruction of the pylorus gives excellent, long-standing results.[6,7] Occasionally, in patients with pyloric obstruction, there is an undue delay in determining whether there is edema from infection and pylorospasm, or whether there is an actual fibrous obstruction before surgery is requested. It is our belief that unless the obstruction at the pylorus can be overcome in a week or ten days by medical management that the case should, without further delay, have surgical interference. Continuing medical management in the face of pyloric obstruction for several weeks serves only to deplete the patient's vital resources, and when it is at last applied, makes surgery more dangerous.

Certain patients with ulcers should be operated upon because they do not respond to medical management. These medical failures may be due to idiosyncrasies or to failure of the patient intelligently to follow the treatment outlined. In such cases we believe very strongly that when surgery is indicated, a short-circuiting procedure should not be used, but that high subtotal resections of the stomach are definitely indicated. It is in this group of cases that the internist and the surgeon must cooperate most closely and must have a thorough understanding each of the other's abilities to deal with the problem in question. It is but natural that internists should be loath to turn over ulcer patients for surgery until the indications for surgery are more than completely fulfilled. This is due to the fact that in the past the mor-

* From the Department of Surgery of the Massachusetts Memorial Hospitals and Boston University School of Medicine. Read before the Brooklyn, N. Y. Surgical Society, October 7, 1943.

tality from resections of the stomach has been high. As surgeons improve their technic and this mortality reaches the very low and very reasonable figure which it should approach (i.e., under 5 per cent in our experience), it is to be expected that the internist will turn over these debatable cases at an earlier stage for surgery. In this disease, as in many others, surgeons have had to prove their competency.

The question of repeated bleeding as an indication for surgery has many angles for discussion. We are inclined to believe that when an ulcer patient is past middle life and has had repeated serious hemorrhages, he has, in all probability, an ulcer of the posterior wall of the duodenum, which experience shows will not do well with medical management. Assuming that he is in good condition, a resection of the stomach is usually desirable. In young people with one or two hemorrhages, we are inclined to continue with medical management.

As we see it, the real problem for the surgeon is the consideration of immediate surgery in the patient past middle life who comes into the hospital more or less exsanguinated by a severe hemorrhage from the stomach. We have found it hard to convince ourselves that such critically anemic patients should be subjected to immediate subtotal gastrectomy. A man of sixty-five with an indurated, acutely inflamed duodenal ulcer which has bled so badly that his hemoglobin and red cells are markedly reduced, presents, in our hands, a very poor risk for radical gastric surgery. It must be remembered that surgery in these individuals must consist of a radical resection of the ulcer, if we are going to accomplish control of the fundamental difficulty, which is severe hemorrhage from the bed of the ulcer. We prefer in these individuals to risk medical management for a period of weeks or months and improve their general condition. We then can review the situation with the idea of resecting the stomach at that time, if it seems desirable. We have not yet been convinced that radical gastric surgery in the presence of an acute hemorrhage in an old person is the procedure of choice.

The final indication for surgery in peptic ulcers is the question of possible malignancy in the ulcer. This, of course, applies almost entirely to lesions of the stomach, although occasionally the roentgenologist cannot be sure whether the lesion is pyloric or duodenal.

While surgeons have become increasingly conservative in their acceptance of duodenal ulcer patients for surgery, it seems to us that they have perhaps become over-conservative in their acceptance of patients having gastric ulcers. When one considers the incidence of malignancy[1] in gastric ulcers, depending on the location of the ulcer, one must seriously consider more frequent radical resections. Allen[1] reports a diagnostic error of 14 per cent in 277 cases. In our clinic we are becoming increasingly anxious to operate upon gastric ulcers at an early stage after their diagnosis, rather than spend weeks in delay for accurate diagnosis of the type of lesion. We are completely convinced that our only hope of getting ahead of cancer of the stomach is to operate more frequently on ulcers of the stomach. By doing this we may remove a few ulcers which are benign and which perhaps would have healed. We believe, however, that this is of relatively little importance, since, at the same time, we undoubtedly shall have removed certain very early malignancies which otherwise would have spent weeks in developing before they were operated upon. One must not forget that many gastric cancers go from debatable lesions to inoperable growths in a few weeks.

Our general tendency, then, in the selection of patients with peptic ulcer for surgery is to become increasingly conservative in the advice for operation in duodenal ulcers, and to become increasingly radical in advising surgery for all gastric ulcers.

The selection of any patient for gastric resection requires on the part of the surgeon not only careful information as to the

precise reasons for gastric resection, but also requires a consideration of the patient's age, nutrition, cardiovascular status, anemia, and protein reserves. It has become increasingly apparent to us that the matter of old age is no absolute contraindication to gastric resection, since several of our patients in their late sixties, early seventies, and even one over eighty, have done well with gastric surgery. The state of the patient's nutrition and the degree of anemia, however, are of great importance and are some of the details of preoperative management that should require particular attention. The cardiovascular status of the patient is also highly important. Patients who have had coronary infarcts, chronic asthma or bronchitis make very poor operative risks; and in these patients, if cancer can reasonably be ruled out, one must use prolonged medical management before advising surgery.

PREOPERATIVE CARE

The preoperative preparation of the patient for gastric surgery may require several days or even weeks and demands particular attention to details. Inasmuch as these cases usually fall under the category of elective surgery, adequate time should be taken to secure optimum conditions, and the more meticulously careful we are at this stage, the better the convalescent period will be.

Particular attention is paid to the correction of anemia and hypoproteinemia. One or more transfusions are given preoperatively. It is our experience that the red cell count is not materially elevated after transfusions subsequent to the first one or two. We, therefore, resort to the additional use of plasma transfusions and intravenous amino-acids to restore the protein stores.

In anticipation of possible multiple transfusions it has been our custom recently to have Rh factor determinations done preoperatively on all contemplated gastric resections. On several occasions we have encountered Rh negative patients, and thus were able to avert possible transfusion reactions.

Finally, on a few of the more debilitated patients with low serum protein we have performed preliminary jejunostomies for pre- and postoperative jejunal feedings. This, of course, makes the gastrectomy somewhat more difficult if done preoperatively; but in addition to affording a means of restoring protein, it affords a chance to explore the stomach at the time of the jejunostomy. The patient is given a simple peptonized jejunostomy formula[5] through the tube and, in addition, amino-acids can be administered in this way.

We are in the habit of having a liter of compatible blood available in the room at the time of operation; and if the patient has poor veins, we insert a cannula into one of the ankle veins to facilitate intravenous therapy during the operation.

A careful dietary history and blood cevitamic acid levels preoperatively give useful information regarding the vitamin C needs. This is administered in the form of 100 mg. cevitamic acid tablets three times a day by mouth if there is no obstruction. If there is obstruction, we give it in the intravenous fluids in greater amounts (500 mg. daily) to allow for some spillage in the urine. Prothrombin time values are also performed routinely and parenteral vitamin K is administered when indicated.

Needless to say, each patient is carefully evaluated as to his cardiovascular-renal status. Even in the absence of frank cardiac disease a routine electrocardiographic tracing and cardiac consultation are obtained to serve as a base line and aid to the consultant later, in the event of possible pulmonary or cardiac complications. Occasionally, the differential diagnosis between coronary disease and pulmonary embolus is a difficult one and a preliminary electrocardiographic tracing is a welcome aid.

Similarly, a routine preoperative chest film is taken, not only to rule out metastasis in cancer cases, but also to serve as a comparison film later in the event of pulmonary complications. Although non-

protein nitrogen determinations are routinely carried out, we believe, as Graves and Militzer[8] have pointed out, that a carefully done phenolsulphonphthalein excretion test is a much finer index of early renal damage and serves as a warning to greater care in fluid and electrolyte balance consideration.

In cases with pyloric obstruction in which there is a large gastric residue, we place the patient on a constant Levine tube drainage with Wangensteen suction for some days. We also administer maximum doses of vitamin B and C parenterally. This serves not only to cleanse and decompress a dilated stomach but also reduces the edema and prepares a stomach for a much easier operation. Not infrequently this regimen will serve to reduce edema sufficiently to allow the passage of food through a previously completely obstructed pylorus. The tube can then be removed and nourishment given orally for several days before operation.

All patients for gastric resection have a Levine tube in the stomach with suction for twelve hours or more before operation and come to the operating room with the tube in the stomach. During the operation, suction may be applied to this tube, as needed, to empty retained fluid.

OPERATIVE PROCEDURE

The type of anesthesia for gastric surgery will vary in each clinic with the preference of the surgeon and more particularly with the ability of the anesthetist who works with him. The use of the same anesthetist by a surgeon in all his more difficult cases has many advantages. Each learns to know the other's technic and is, therefore, much better able to co-operate with the other. Certainly if we could have but one person regularly on our surgical team, we would choose an expert anesthetist for this position.

We prefer spinal anesthesia for all our cases of gastric resection. In our opinion, the increased speed and ease of operation more than offsets its dangers. No fatalities or fatal complications in our recent experience can be laid to spinal anesthesia.

Recently, our anesthetist has been using continuous spinal anesthesia, following the technic of Lemmon,[9] and this has been the most satisfactory anesthesia we have yet enjoyed. The advantages of continuous spinal anesthesia, as we see them, are not only related to the fact that in prolonged procedures the surgeon may have persisting complete relaxation of the abdominal muscles, but also to the fact that in certain cases in which exploration shows that the gastric lesion is inoperable, the anesthesia can be readily terminated. Occasionally, in the long cases with continuous spinal anesthesia, the patient must be given pentothal intravenously or some gas-oxygen anesthesia to abolish traction reflexes and to avoid general discomfort.

TECHNIC OF RESECTION

In recent years there has been a tendency to pay relatively slight attention to a discussion of the actual technic of operative procedures and to spend increasing time in consideration of the physiological factors involved in the disease proper. We believe that good technic and manual dexterity are essential to a surgeon, and that the precise methods of carrying out the technical procedures of an operation are still of great importance to all of us. We wish to discuss in detail the technic that we follow:

For patients upon whom gastrectomy is anticipated, we make a long incision, which varies from the right to the left side of the abdomen, depending upon whether the major lesion is in the pyloric end of the stomach or duodenum, or whether it is in the lesser curvature or fundus of the stomach. If the malignant lesion is high on the lesser curvature, we at times find it desirable to cut the costal cartilages on the left side in order to obtain increased exposure.[4]

In considering the technic of gastric resections we wish, first, to discuss our technic for resections of the stomach for

cancer. The abdomen being opened and the lesion being found operable, we start by removing the greater omentum from the color. This can be very rapidly done, only a few blood vessels will need to be tied, and on its completion the great mass of the omentum, the greater curvature of the stomach, and the stomach itself can be readily lifted up. This permits access from behind to the left gastric artery high on the lesser curvature, if desired, and it permits ready observation of any involvement of the pancreas in the tumor before one has ligated the major arterial supply.

The gastrohepatic omentum is now entered with the fingers and radically removed, clamping the vessels as they are encountered. One may now divide the main blood supply high up on the lesser curvature, well above the region of the malignancy, and approach this either from in front of or from behind the stomach.

The vessels above and below the pylorus are now caught and cut, and the duodenum is brought into view where it can be readily and safely clamped. For cutting the duodenum we first place our own modification of the Furniss clamp[3] on the duodenum with an Ochsner clamp above it, and divide the duodenum just beyond the pylorus with the actual cautery. With the modified Furniss clamp the closure of the duodenum can be accomplished without soiling and in very short time. The covering of the clamp on the distal end of the stomach by a piece of Penrose tubing, as recommended by Taylor,[10] quickly takes care of this possibly soiled area. With multiple fine silk sutures the duodenum is now closed by turning in the ligated cap with at least two layers of mattress sutures. Finally, it is folded over into the head of the pancreas with more silk sutures.

The stomach and the attached duodenum are now lifted high out of the abdomen and an anterior Pólya type of anastomosis with the jejunum is made. We have thus far not used an "aseptic" anastomosis, but as much soiling as possible is avoided by the use of rubber-covered clamps and careful draping of the area with wet pads. When a total gastrectomy is done, the jejunal loop is held against the diaphragm and then anastomosed, end-to-side, to the esophagus.

Resection of the stomach for duodenal ulcer is carried out by much the same technic as for cancer of the stomach except that the omentum is not covered in its entirety and a much less radical removal of the gastrohepatic omentum is necessary. In all our resections for ulcer two-thirds or more of the stomach is removed.

It is essential in every case that the pyloric mucous membrane be removed. We prefer, if possible, to remove the pylorus itself and almost invariably we can do this. Attempts at removing the mucous membrane and sewing over the pyloric muscles are apt to result in a wad of tissue at the pylorus, the closure of which may be unsatisfactory.

In most instances the duodenal ulcer is removed in the resection. In some cases, however, the ulcer is so edematous and so close to the common duct that removal of the duodenum containing the ulcer seems to us to be too dangerous. We have no hesitation in these cases in leaving the ulcer behind, provided the pyloric end of the stomach is completely removed. We have not encountered later trouble from these cases and believe this is safer than any radical attempt to remove an ulcer involving the common duct.

As in resections of the stomach for cancer, the method of closing the duodenum is one of the most important details of the operation. Failure to obtain a satisfactory duodenal closure is very likely to result in a leakage and serious trouble, if not a fatality.

The anastomosis between the stomach and the jejunum is carried out by bringing the jejunum anterior to the colon is almost all of our recent cases. We have had less trouble with postoperative vomiting and difficulty since doing anterior Pólya's than we had previously with posterior Pólya operations. Occasionally, when the jejunal

mesentery is short and when the omentum is heavy, it is necessary to resect a piece of omentum from the colon in order to make it possible to bring the jejunal loop up to to the end of the stomach.

In all of these anastomoses we use two layers of sutures, the inner layer being cargut, with a baseball stitch, the outer layer being continuous silk.

In patients who have had obstruction, who have had hypoproteinemia preoperatively, who have lost weight and are generally depleted, we do a jejunostomy[5] for postoperative feeding, as soon as we have finished the Pólya anastomosis. This jejunostomy takes only three or four minutes and thus far has not been the source of any postoperative difficulty.

We now use sulfanilamide powder in the abdominal cavity around the suture line, around the duodenal stump, and in the abdominal wound in all resections of the stomach. Anglem and one of us (H. M. C.)[2] recently reviewed the results of this procedure in a large group of gastric and intestinal resections. In no case in which death occurred was peritonitis present. We are convinced that this is a great addition to the surgery of gastric resections, and that placing this drug in the peritoneal cavity is better than giving it by mouth because of the high concentration obtained in the local area of soiling. The amount of sulfanilamide powder that we use varies, of course, with the size of the patient, but, on an average, consists of 8 Gm.

In most patients we close the abdomen by first placing through-and-through heavy silk stay sutures which pass through all layers of the abdominal wall and which are spaced three-quarters of an inch apart. After these are placed, the various layers of the abdominal wall are sutured with short continuous catgut sutures and the stay sutures are then loosely tied. We use No. 0000 catgut for the ligation of all vessels in the abdominal wall and No. 0 chromic catgut for the peritoneum, transversalis, and rectus fascia. With this method we have had no ruptured wounds, and infection has been so rare and so mild as to be unimportant.

POSTOPERATIVE CARE

Meticulous postoperative care begins as soon as the patient leaves the operating room. The anesthetist accompanies the patient back to the ward and arranges his position in bed, orders the indicated parenteral fluids and personally inserts the nasal tube or arranges the oxygen tent and leaves the patient with a clear airway. The Levine tube, still in place, is immediately attached to Wangensteen suction.

We are convinced that two of the most important factor in successfully bringing a gastrectomy patient through the postoperative period are adequate and constant nursing care and a vigilant house staff constantly on the alert for possible complications. Whenever possible a special nurse is obtained. On ward cases this is made possible through a special fund which we have at our hospital for this purpose.

Careful precautions are taken to prevent atelectasis. The patient's position in bed is changed hourly from side to side and the patient is encouraged to cough. If it is evident that there are excessive secretions collecting in the trachea and bronchi, we resort to thumping the patient's back with the open palm while supporting the area of the incision with the opposite hand. The attending nurse is carefully instructed in this procedure and the patient is awakened each hour to change his position and thump his back. This may perhaps seem a little cruel at times, but the results are gratifying. This maneuver is carried out, first, with the patient on one side and then on the other and is continued until the specimen of mucus is raised. Following this, carbon dioxide is administered for one or two minutes, either by paper bag rebreathing or direct carbon dioxide oxygen inhalations with a bedside tank and mask. In the event that the mucus cannot be raised by encouraging coughing and back thumping, the pharynx and trachea are aspirated, using a small nasal catheter and

a bedside suction apparatus. Rarely is it necessary to resort to local anesthesia of the pharynx for this purpose and with a little practice the catheter can almost invariably be manipulated into the trachea. The stimulation of the procedure often causes expectoration of the mucus. On the rare occasions when this method fails and atelectasis is present, the patient is taken to the operating room and the secretions are removed by direct bronchoscopy.

A Levine tube left in place for any length of time is a hazard and predisposes to upper respiratory infection. For this reason we frequently remove the tube on the second or third postoperative day. This affords the patient much comfort and we believe that there is no danger in reinserting the tube each morning and evening for a few days to determine the amount of gastric residue. If it is necessary to leave the tube in longer, just removing it temporarily for a few hours or for the night affords considerable relief. Frequently anointing the Levine tube with Nupercaine ointment is another measure which makes it much less offensive to the patient and cuts down pharyngeal irritation. While in place, the Levine tube is irrigated every two hours with 20 cc. of saline to insure its patency.

The high spinal anesthesia used for gastric resections usually paralyzes the intercostal nerves at least up to the fifth dorsal area. In over half of our cases sodium pentothal is used as a complementary anesthetic to abolish traction reflexes. Thus, the central respiratory depressant effect of the sodium pentothal and the high spinal anesthesia usually result in rather shallow respirations. For these reasons our anesthetist starts the administration of oxygen during the operation and this is continued immediately on putting the patient back to bed, by means of nasal oxygen or a small oxygen tent, as a supportive measure to insure adequate oxygenation of the blood.

Our patients are given water by mouth on the first postoperative day in small amounts (1 dr. every one-half hour). On the following day this is increased to 2 dr. every half-hour, and by the third day they are taking 2 ounces an hour. This can do no harm because most of it comes back out through the Levine tube and it is a great comfort to the patient. Our diet rapidly increases from this point onward so that malted milk is taken on the fourth and fifth days, gruels, jello and custards on the sixth, and fluids as desired, with soft boiled eggs and cooked cereals by the seventh day.

Supplementary vitamins are administered in the intravenous fluids and intramuscularly until the patients can tolerate them by mouth.

A careful and frequent check of the red cell count, blood chloride, cevitamic acid and total protein levels serves to guide us in the administration of intravenous fluids, whole blood, plasma, and amino-acids. We try to maintain a fluid intake of at least 3,000 cc. daily and a urinary output of over 1,500 cc. In elderly patients and especially in those with cardiovascular-renal disease or low protein levels we guard especially against giving too much saline solution.

If the patient has had a jejunostomy, the formula is started in from twenty-four to thirty-six hours postoperatively. Unless peristalsis is completely absent, we inject from 25 to 50 cc. of water or saline into the jejunostomy tube every two hours, beginning eight or ten hours postoperatively. The following day the formula[5] is started, diluted half and half with saline, giving 50 cc. of this every hour. If this is tolerated well, if peristalsis is present and there is no distention, it is increased to 100 cc. an hour, and the next day the full strength formula is used. In order to utilize the electrolytes and gastric secretions lost by suction, these also are mixed with the formula. By gradually accommodating the bowel to the formula we have had excellent success. Patients on this regimen usually have two or three soft bowel movements a day, but we have had little trouble with

diarrhea and have been able to deliver about 2,000 cc. of formula each twenty-four hours, which gives the patient 1,520 calories.

It is essential that the formula be made up in small, fresh lots daily and that it be warmed to body temperature before giving it. We deliver it through a Kelly flask, with a large rubber tube leading to the jejunostomy and regulate the flow by means of an air bubble water chamber attached to the top of the Kelly flask.

The large size of the delivery tube prevents coagulation and it is essential that only small amounts of formula be placed in the flask at once and that the apparatus be cleansed and boiled daily to prevent souring.

If a patient has to be catheterized more than twice postoperatively, an indwelling catheter is left in place and sulfadiazine is given prophylactically in small doses.

On the first or second day postoperatively systematic leg exercises to prevent thrombophlebitis are instituted and if an intravenous cannula has been placed at the time of operation, careful attention is given to the wound to prevent sepsis.

We have had cases in which the gastrojejunal stoma was delayed in assuming its function and these have been successfully handled by beginning over on the ascending diet scale, meanwhile relying on the jejunal feedings or intravenous therapy for nourishment.

Skin sutures are removed on the ninth day. In cases in which a muscle-splitting incision is used, the through-and-through braided silk sutures are left in place until the patient is up and are removed on the twelfth to fourteenth postoperative day. The usual gastrectomy patient is allowed to "dangle" on the eleventh or twelfth day and is out of bed on the thirteenth or fourteenth postoperative day.

SUMMARY

It is apparent from the foregoing that the successful management of gastric resections demands not only a skilled surgeon, anesthetist and operating team, but also the most painstaking preoperative and postoperative care by the hospital personnel. Years ago we found that the reduction of mortality in operations for hyperthyroidism came only when the internist and the anesthetist united with the surgeon in a study of the disease and its mortality-producing factors. Similarly combined efforts are now bringing the mortality of gastric resections to a figure which permits the medical men to recommend surgery for peptic ulcers when they first suspect it may be necessary.

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COMMON KNEE INJURIES

SOME ASPECTS IN DIAGNOSIS AND TREATMENT

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THE knee joint is important as an industrial and compensation problem. In the Army the orthopedic surgeon is confronted with all the problems in reference to the knee joint that one finds in civilian life, plus the great increase of injuries due to the nature of the soldier's training and actual combat duties.

The three most important conditions resulting in internal derangement of the knee joint are traumatic synovitis, tear of the menisci, and osteochondritis dissecans. The percentage of new injuries seen in the Army is high. Chronic knee conditions are usually old injuries received in civilian life which may have become aggravated by military service.

A young man who worked as a clerk or a salesman and who is suddenly placed in a strenuous basic training course is prone to knee injury. The athlete who has suffered injuries to his knee prior to induction may in the course of the first three months of army training report on sick call because of a painful knee. However, many athletes with knee injuries compensate for such during basic training by their agility and excellent ligamentous and muscular development about the knee joint.

In the Navy these same conditions exist but to a lesser degree. If the Navy recruit gets by his basic training period, he has less likelihood than a soldier of future knee injury. The terrain and the nature of the soldier's duties favor injury to the knee.

Traumatic synovitis, when it occurs repeatedly, may result in a chronic arthritic knee joint producing a severe disability for full duty. The synovial membrane of the knee joint has been classified[1] into three main types, namely, the fibrous, the adipose, and the areolar. There is an abundant blood supply especially in the areolar type of subsynovial tissue, while the adipose type is moderately supplied and the fibrous type least supplied with blood. Albumin, globulin, and mucin are normal constituents of the synovial fluid which is a clear, yellow, oily fluid formed by the cells of the synovial lining. The mucin which forms a basis for the lubricating action distinguishes the synovial fluids from body fluids which are plasma dialysates.[2] The stimulus for the production of normal synovial fluid is motion. Thus, after a period of prolonged immobilization the joint becomes relatively dry, and this leads to degenerative changes in the articular cartilage and stiffness of the joint. In trauma blood frequently escapes into the joint. If the collection of blood is large, a portion of the hematoma may remain, eventually becoming organized and forming adhesions.

The layman usually refers to the painful, swollen knee due to acute traumatic synovitis as "water on the knee." A few pertinent statements about the treatment of this common condition are necessary. The anatomy of the knee joint is such that when it is filled with fluid a cavity (quadriceps pouch) extends several inches above the patella and its tendon and posteriorly over each condyle. One can visualize how it is possible for a large amount of fluid to be accumulated in the knee joint in traumatic synovitis. One hundred to 200 cc. of serosanguineous fluid is frequently aspirated.

There should be a routine method of treating traumatic synovitis of the knee joint. The usual cause is a sudden twisting motion as in going over an obstacle, immediately, there is pain followed by swelling. The treatment which has been most beneficial in the majority of these injuries

is as follows: (1) Roentgenograms of the injured knee and the opposite one for comparison; (2) aspiration; (3) compression

Fig. 1. Fig. 2.

Fig. 1. Osteoarthritis, traumatic, right knee, severe; result of repeated traumatic synovitis.
Fig. 2. Osteoarthritis, traumatic, right knee, severe; tunnel view.

dressing; (4) complete bed rest with the extremity elevated; (5) analgesia, and (6) physiotherapy after the effusion has subsided. The knee should be aspirated in the usual manner with an attempt to get all the fluid out by compressing the sides of the knee joint. A compression flannel bandage is then applied extending from the middle of the leg to the middle of the thigh. Elevation of the extremity with the knee straight or in traction with Buck's extension should be maintained for approximately five days. When the effusion has subsided, physiotherapy can be instituted.

The above procedure, if properly carried out, may help to prevent an acute condition of the knee from being transformed into a chronic painful knee due to adhesions caused by organized hemorrhage. In the event the effusion recurs another aspiration may be necessary. The surgeon upon opening into the synovia very often will see these residual adhesions in a patient's knee who in the past has had several episodes of traumatic synovitis.

A soldier with a history of trauma to the knee joint may have sustained injury to local areas of the fibrocartilage[5] with a resulting partial split or degeneration which would make the cartilage more vulnerable to a tear with a new injury. A patient with this history is usually a candidate for operation. Preoperatively, a diagnosis of a ruptured meniscus with displacement is most likely if on physical examination there is limitation of complete extension, and tenderness at the medial compartment of the knee. The other signs, such as effusion and atrophy of the quadriceps muscle, may or may not be present. When a dislocation of the meniscus occurs, it is at the anterior, the posterior, the central, the entire meniscus or it may reveal only a generalized laxity. Roentgenograms taken for soft parts may be of value if one is familiar with this type of examination. Vacuum studies and the injection of oxygen into the knee joint have been reported by some investigators as useful diagnostic aids. The oxygen method is not without danger to the patient. The history and physical examination are the most important factors in determining operative intervention.

During basic training a soldier who never had any pre-existing knee injury may traumatize his knee by either stepping into a hole, falling over an obstacle, kneeling

down, taking part in authorized athletics, or in a motor vehicle accident. The usual story is as stated above and the mechanism

disease, traumatic arthritis involving the femur and tibia, or arthritic changes in the patella. Figures 1 and 2 are roentgenograms

Fig. 3. Fig. 4. Fig. 4.

Fig. 3. Osteochondritis dissecans; tunnel view; fragment ready to separate.
Fig. 4. Traumatic loose body attached to tibial plateau; lateral view.
Fig. 5. Loose fragment 2 cm. by 2 cm. removed from intercondylar space.

is the opening of the medial joint space. The leg is abducted upon the thigh causing the medial meniscus to become lodged between the tibia and femur. The combination of a tear and dislocation of the meniscus usually results in locking. This, however, may be momentary and the soldier frequently unlocks it himself. If unsuccessful, he seeks medical aid and the surgeon may elect to unlock the knee by manipulation with or without anesthesia. The soldier may never come to surgery and go on to do full duty without another knee injury.

The soldier who has suffered a knee injury prior to induction presents a different problem. A recurrence of his old knee injury may take place. On physical examination the quadriceps muscle is usually atrophied and weakness is noted upon resistive extension tests. There may be tenderness over the medial joint space and moderate effusion. In this type of knee injury roentgenograms are frequently helpful. One may find a Pellegrini-Stieda's

of a severe traumatic arthritis of the knee in a soldier who had served over twenty-three years in the Army where he sustained twisting injuries to his right knee with resulting synovitis. His disability is considered severe because of the arthritis in only one knee which permanently disabled him.

A large percentage of knees will show osteochondritis dissecans in early and late stages. Repeated trauma producing synovitis not properly treated and repeated injuries to the joint or nearby bone will cause changes in the cartilaginous surface. The articular cartilage instead of being smooth, moist and whitish becomes rough and dry with occasional fissures. Mucoid degeneration occurs, and with continued wear and tear, the articular cartilage may be worn off so that the subchondral bone is the articulating medium. This is the beginning of a chronic arthritic knee. Loose bodies may be extruded into the joint cavity by the breaking off of fragments either of the cartilage or marginal osteo-

phytes. Osteochondritis dissecans is a form of aseptic necrosis originating from any area in the knee, be it the patella, femur

Fig. 6. Parapatella incision; distal portion of general utility incision.

or tibia. The most common area is on the femoral condyle. It may be attached firmly in the early stage with a film of very thin fibrocartilage covering it, or there may be a definite lacuna. Figure 3 is a roentgenogram of a knee in a patient twenty years of age with nine months of service in the Army who gave a history of having been struck in the back of his knee two years prior to induction. During basic training while drilling, marching, and taking part in calisthenics, he had the feeling that his knee was "giving way." On admission there was restriction of flexion to about ninety degrees, tenderness over the medial compartment, one-half inch atrophy of the quadriceps muscle and moderate swelling. At operation the osteochondritic body was easily removed from its bed on the femoral condyle. The microscopic pathological report was as follows: "The articulated bone shows thickened and sclerosed trabeculi, fibrosis of the marrow, vascularization and fraying of the articular cartilage." On occasion one may see bilateral osteochondritis dissecans in the same stage of development.

In many injuries to the knee a fragment

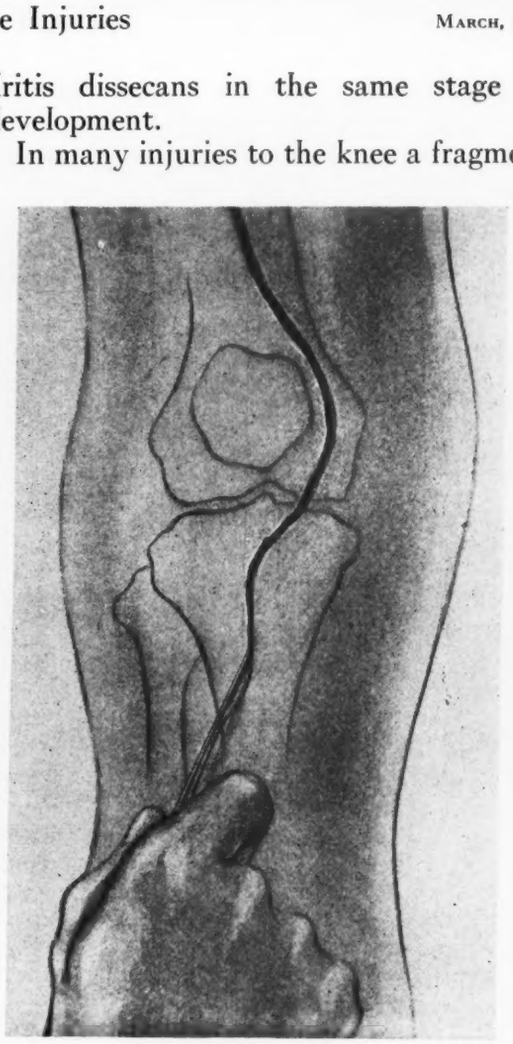

Fig. 7. General utility incision; diagrammatic sketch. (A. Krida. *J. Bone & Joint Surg.*, 15: 897, 1933.)

of bone originating from the tibial plateau can be considered as a loose body not due to aseptic necrosis. Figure 4 is a roentgenogram revealing a traumatic loose body caused by an injury received in an automobile accident. Figure 5 is a photograph of the loose body which was removed. The usual joint mouse is a smooth body about the size of a lima bean composed of cartilage. Roentgenograms should be taken immediately prior to operation in order to localize the loose body. Other calcified bodies reported from the roentgenogram examination may be attached to the synovial membrane. The above types of osteochondritic bodies should be distinguished from the condition known as osteochondromatosis.

When it has been decided that an operative procedure is necessary, what is the type of incision to use? What is the postoperative care? What is the reconditioning program to which the soldier must be subjected before he is fit for active duty? The operation is only part of the treatment. The postoperative treatment is extremely important. Contrary to what some individuals have said, there are very few so called "gold bricks" who come to surgery. We are careful to select for surgery patients who give a good history and who present positive physical signs. We have seen an occasional patient who desired to remain in the hospital a little longer, and who complained about his knee without any apparent cause. This type of patient is usually placed on the reconditioning program where special remedial exercises and psychotherapy are instituted. The average soldier realizes that the knee joint is important and that in order to obtain a good functional knee he must co-operate with the surgeon. He usually exercises and after a short time sees the benefits. It has been the misconception of the layman that a stiff knee will result from operation. Consequently, when these soldiers are placed on a ward where they see other recent postoperative patients being reconditioned, they will do everything possible to get motion and to develop the quadriceps muscle.

The condition which the surgeon expects to find should determine the incision employed. The incision should permit full exposure. In derangement of the medial meniscus the incidence is approximately ten times that of the lateral meniscus. The rupture encountered most often is the so-called "bucket handle" type which is a longitudinal tear with the medial half displaced in the intercondylar notch while the other half remains attached. The parapatella incision is the one most often used for excision of the medial meniscus by the general surgeon. Figure 6 is a photograph of the parapatella incision. However, the general utility incision as described by Dr. Arthur Krida,[3] in 1925, gives a good exposure to the entire knee joint, and when the diagnosis is doubtful this incision

Fig. 8. General utility incision three weeks old; note small incision from previous operation.

will be of great help. Figure 7 is a diagrammatic sketch of the general utility incision. The author describes his incision for exploration of the knee joint as follows: "With the limb extended the incision is begun four inches above the patella in the line between the rectus femoris and the vastus internus passes downward to within one-half inch in the superior border of the patella then sweeps inwardly around the patella about one-half inch from its inner border, then downward to the tibial tubercle. The quadriceps pouch is then explored after which the patella is dislocated outside the external condyle and the joint flexed to ninty degrees, when the rest of the joint cavity becomes visible. It may sometimes be necessary to split partially the infrapatella pad of fat to explore fully the external compartment." When one suspects more than a tear of the meniscus, the lower half of the general utility incision may be made and if the disorder is found that will be sufficient exposure. However, the lower half may be

extended upward and the general utility incision completed for more exposure. This is often necessary in osteochondritis dissecans and where involvement of the patella or hypertrophy of the synovial membrane has been found. Figure 8 is a photograph of a recent postoperative knee in which osteochondritis dissecans and superficial degeneration of the articular cartilage of the patella were found. This patient had a previous operation for excision of the medial meniscus overseas. Note the small incision for menisectomy.

Dr. David M. Bosworth,[4] in 1937, described an incision for exposure of the anterior and posterior compartment of the knee joint through a single skin incision and a double capsule incision, avoiding the possibility of injury to the patellar branch of the saphenous nerve and the presence of a second skin cicatrix. This procedure allows complete removal of the meniscus and is also useful for excision of cysts of the meniscus.

The use of the tourniquet is a controversial point. Many surgeons use it on every knee operation while others select certain types of injuries. There are many kinds and methods for its use. The pneumatic tourniquet can be easily released at any time prior to closure of the incision if the surgeon wishes to ligate the blood vessels. The Esmarch rubber bandage and the flat rubber tourniquet with a buckle that can be released are useful. In applying a tourniquet the limb should be elevated for a few minutes and an elastic bandage applied from the toes to the mid-thigh in order to "milk out" any remaining venous blood, before obtaining hemostasis with the tourniquet high on the thigh.

We are all familiar with the fact that each patient is an individual and must be treated as such. No two patients are the same. Therefore, we can use only averages when speaking of the number of days or weeks necessary for the different routine steps in the postoperative care of knees operated upon for excision of the meniscus or osteochondritis dissecans. The postoperative treatment might follow this pattern:

1. Quadriceps setting exercises encouraged as soon as possible within the first few days. Instruction in these exercises should be given prior to operation. The extremity is elevated upon two pillows with the knee extended or in traction with Buck's extension.

2. Compression dressing is removed on the fifth or the sixth day. Incision inspected, cleansed, and sutures left in. Dry dressing with an elastic bandage applied extending from mid-leg to mid-thigh. Quadriceps exercises continued.

3. Sutures removed on the eighth day and leg raising extension exercises instituted.

4. On the ninth day the patient is encouraged to exercise over the edge of the bed by supporting the operative extremity with the non-operative extremity and flexing it until it becomes pianful. Physiotherapy is begun. Baking of the knee is good as both a psychological and therapeutic measure. The patient feels better and together with exercise definite improvement has been noted.

5. On the tenth day latrine privileges are given, the patient using crutches.

6. On the twelfth day reverse the exercises over the edge of the bed by flexing the operative knee with the non-operative extremity placed on the dorsum of the foot. The elastic bandage should be worn when out of bed. Physiotherapy is continued and exercise on the ward continued under direct supervision gradually replacing physiotherapy.

In the Army the soldier takes part, whenever possible before operation, in daily calisthenics which are given on the ward by trained personnel. Reconditioning exercises are started immediately postoperatively with special emphasis placed upon the development of the quadriceps muscle. The atrophy and disabling weakness which usually follows in arthrotomy of the knee joint has been lessened. The purpose of a program of reconditioning is

to return to duty soldiers who are recovering from injuries or disease in the best possible physical and mental condition. This can only be attained by a determined effort on the part of the reconditioning personnel and the patient. The Army has placed the patients into four classes: Class I are those patients almost fully reconditioned. Class II are those patients who are ambulatory but not on a full program. Class III are those patients who are convalescent and ambulatory still receiving treatment. Class IV are those patients considered convalescent but still confined to bed. The average hospitalization period before return to full duty in arthrotomy of the knee joint is three months. This differs from civilian practice in that the civilian patient convalesces at home. The soldier is reconditioned during his hospital stay. The number of days of hospitalization can be reduced and the soldier returned to duty in a better physical condition after he has participated in a well planned reconditioning program.

The importance of an active program of muscle development and reconditioning cannot be underestimated. Quadriceps muscle exercises in the preoperative and postoperative period is often neglected. Better results can be obtained in these knee conditions if an intensive and instructional program is instituted before surgery upon the knee, and this followed throughout the postoperative period until the patient is fully recovered. The efficient and co-operative program which the Army has established making use of the physiotherapist, occupational therapist, reconditioning officer and surgeon is a big factor in the preoperative and postoperative care of the knee.

SUMMARY

1. The number of knee injuries seen in the Army among new recruits who have never had previous injury is high.

2. Traumatic synovitis of the knee is frequently mistreated. This condition often results in an arthritic knee joint.

3. Tears of the menisci and osteochondritis dissecans present a surgical problem which must be properly handled.

4. Quadriceps muscle exercises in the preoperative and postoperative period expedite recovery.

5. A co-operative program of reconditioning using the knowledge and experience of the physiotherapist, occupational therapist, reconditioning officer and surgeon is essential for good results.

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COLLAPSE OF GLASS EYES IN THE ORBIT

CASE REPORT

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PREVIOUS to my first article,[11] on the "Collapse of Glass Eyes in the Orbit," the literature on the breaking of glass eyes in the orbit was under the title, "Explosion of Glass Eyes in the Orbit," with the exception of one reporting, that being under the title "Spontaneous Rupture of Glass Eye in Situ."

One has never beheld anyone in such a state of utter horror, excitement and bewilderment, until he has seen an individual who has had a glass eye let go in its orbit.

In thumbing over the literature covering the subject at hand, it is found to be very anemic, but to have come in contact with two cases in a five-year period in this immediate locale, one is led to the belief that the incidents are more prevalent than the cases finding their way into the literature.

No mention is made in any of the literature that I can find on safety rules in industries covering workmen wearing glass eyes being considered a hazard, nor is any reference made of it being covered by compensation laws in states which have such laws, in the event a workman receives any injury when a glass eye breaks while in the performance of his duties, when working near a blast furnace or the like.

The manufacturers of glass eyes, when being written to about the breaking of them while being worn, and being asked what caused them to break, and what could be done to prevent it, were very evasive in their answers, some of them not even replying to such inquiries. Several large optical appliance houses were interviewed about their breaking. They did not attempt to give any information or reason for the breaking but they knew that it occurred. The companies that were interviewed do not make glass eyes but only handle them through the manufacturers. One of them informed me that he had artificial glass eyes break while on a tray in a display case, when they were exposed to the sun's rays on hot summer days for any length of time. The percentage was very small, but it did happen. It was always the posterior concave portion that gave way.

Rochester,[1] under the title "Spontaneous Explosion of Snellen Improved Artificial Eyes," does not report any individual cases but the breaking of artificial eyes in the orbit was called to his attention by a fellow colleague. Rochester had never heard or was he conscious of such a happening prior to this. He collected some cases and reviewed the literature. He interviewed some makers of artificial eyes and was told that the air-sealed cavity within the glass eye was less than one atmosphere. No sound reason was given why the breaking was called an explosion. He was told that some of the eyes broke while on the shelves, and that they broke on extremely hot or cold days; also that the makers of glass eyes were going to look into the cause of the breaking and they would like to do something to prevent the occurrence. He mentions that the orbital lining secretions through their chemical action had some effect on the glass eyes. This hardly goes hand in hand, as glass eyes break while on shelves. Rochester was so intrigued with the subject that he brought it up before the Chicago Ophthalmological Society, November 20, 1916.

It will be noted by the statement to Rochester by some makers of glass eyes that they were going to look into the cause of the breaking and that they would like to

do something to prevent the occurrence. This statement was made nearly thirty years ago, but evidently the makers of glass eyes have done nothing about it as they continue to break while in the orbit.

Metz[2] reports on the "Spontaneous Explosion of Artificial Eyes" and cites one case. A patient wearing a Snellen artificial eye reported that a few hours before, as he was crossing a vacant lot, he had been shot, the bullet striking his artificial eye (eye not mentioned). Although he could see no one about, yet he had heard the sharp report of a gun, and had felt the impact of the bullet on the eye. An attempt was then made to remove the eye from the orbit, and a little difficulty was experienced. Usually an artificial eye can be removed very easily, but for a reason not apparent the eye resisted removal. Finally, the attempt at removal succeeded, and it was observed that a slight hemorrhage was occurring from that portion of the conjunctiva which had been in contact with the central portion of the posterior wall of the eye.

Inspection of the eye revealed an irregular round opening about 5 mm. in diameter in the posterior central portion. A number of small fragments of glass were found within the interior of the eye. Quite apparently when the wall of the eye ruptured, the fragments were forced into the cavity and the conjunctiva was drawn into the eye by virtue of a vacuum which existed inside the glass globe. Retention of the conjunctiva in this hole in the eye explained the difficulty which had been experienced in removing the ball from the conjunctival sac, and also explained the slight injury to this portion of the conjunctiva.

At the time of the patient's visit the cause of the breaking of his eye was not clear. It could not be assumed that the eye had actually been struck by a bullet, and that without doing any damage whatever to the anterior portion, a gunshot should have occasioned so peculiar a fracture of the posterior wall. It was later that the possibility of an explosion of the glass eye was considered.

Weilder[3] records one case under the title "Explosion of the Snellen Eye in the Orbit." He states that the explosion of the Snellen artificial glass eye while in the socket is a unique accident and seems to the writer (Weilder) to be worthy of record.

Also, the Snellen "reform" eye has so many well known advantages over the old style that it is needless to mention them at this time. The only disadvantage seems to be this tendency to explode.

The patient has been wearing Snellen reform eyes (left) which were made to order for the past ten years. The eye that exploded had been in use for only one year. The date of the breaking was August 1, 1916. She had been cooking over a hot stove and walked to the door where it was cool, when there was a peculiar noise in her head, which was followed by pain in the socket, and she thought she had been shot. She walked to her bedroom and fainted from fear and shock. When she recovered consciousness, she attempted to remove the glass eye and found it difficult to do so, on account of the great "suction" or vacuum. When the eye was removed a hole was found in the central part of the rear surface about 4 by 6 mm. in size. The piece that had broken out had fallen into the socket.

The patient said that the noise caused by the explosion was similar to the bursting of an electric light bulb.

Urbanek[4] presented a case of an explosion of an artificial eye in the right orbit, before the Vienna Ophthalmological Society, February 18, 1924, First Service of the Eye Clinic, his case being that of a woman fifty-three years of age. She had had tuberculosis of the right eye, and the eye was removed when she was seventeen years of age. A glass eye was put in. One morning in the early part of February, 1924, she stooped down and in doing so thought something had struck her in the region of the right temple. This was followed by pain in the right orbit, associated

with a flow of tears, and the tears were bloody. In vain she had sought to remove the artificial eye. She was brought to the clinic shortly after in the ambulance. While in the clinic she was seen by Professor Meller, and he pointed out to us the possibility of a spontaneous explosion of an artificial eye within the orbit. He separated the lids and he had much difficulty in removing the artificial eye. The back portion of the eye was found to have a piece broken out of it. The opening measured 10 mm. long and 5 mm. wide.

Urbanek, in presenting this case, also referred to Kayser, of Stuttgart, who had a similar case in 1918 of an explosion of an artificial eye in the orbit. Difficulty was had in removing the eye, and Kayser mentioned the importance of having a lever made to remove any eye in the future. Urbanek, in the case he reports, does not make any reference to the piece that was broken out in the back of the glass eye; that is, if he looked for it, and if located what was the location. He does not state how long the eye had been in use, or whether the eye showed any erosions. In fact, he makes no mention of the secretions of the orbit.

Lewis[5] cites one case of "Explosion" of Artificial Eye in the Orbit, and I quote him verbatim:

"Whether the 'Explosion' was due to positive or negative air pressure within the glass eye, or from pressure of the surrounding orbital tissues upon it, cannot be determined. But removal of the eye (eye not mentioned) from the orbit, afterward, was accomplished with difficulty, on account of suction within, which held a tuft of the conjunctival tissue fast in the aperture in the glass, and necessitated considerable force to pull it loose.

"The patient is a mechanic of superior intelligence and his description of the occurrence is most interesting. Sitting in the power station, while on duty, he was reading when an explosive-like shock took place in the orbit. Fellow workers, who were looking directly at him at the moment, state that his head jerked violently backward.

"He immediately felt pain in the orbit and upon attempting to remove the artificial eye, which he could, ordinarily, do with ease, he found that something held it fast (suction), and it had to be wedged out with considerable force. The conjunctiva over the stump was found to be bleeding and slightly lacerated. Close examination of the glass eye showed an aperture in its posterior, concave surface, about 5 mm. in diameter. The broken glass pieces were contained within the eye and slightly blood stained.

"The glass eye was entirely smooth, showed no erosion, as is commonly found after long use, nor is it perceptibly different from the usual prosthesis. The patient had worn a glass eye for many years and this particular one about six or seven months. It was an exceptional experience to both patient and surgeon."

McKee[6] cites three cases but does not attempt to give any cause for their breaking. His recordings are under the heading of "Explosion of Artificial Eyes in the Orbit."

His report is as follows, and I quote him in full: "Dr. W. W. Lewis' report in the December number of the Journal, page 923, (American Journal of Ophthalmology—Vol. 10, page 923–924, December, 1927), prompts me to record a small series of such cases which I have intended reporting for some time. They all occurred in 1923 and January, 1924.

"M. McF., an adult male, while at his work, had the glass eye on the right side explode. The artificial eye was completely demolished and when I saw him within an hour or two of the accident he was in quite a state of shock. I removed innumerable small pieces of glass from the socket.

"G. S., a young woman of twenty-two years, within a few months during 1923 had three glass eyes explode in her orbit (eye not mentioned). This patient had been most particular about her artificial eyes and had gone to most of the large American

cities in search of the best that could be procured.

"In January, 1924, A. M., an adult male of twenty-eight years, came to have his eye socket inspected, (eye not mentioned) as the day before an artificial eye had exploded in the orbit. He said "he felt as if his brains were being knocked out," and when I saw him he was still in a very nervous state."

Dunphy[7] reports one case of "Explosion of Artificial Eye in the Orbit" as follows: "Since reading the case report of Dr. Wm. W. Lewis in the December issue of the Journal (American Journal of Ophthalmology—Vol. 10, page 923–924, December, 1927), I have seen a similar case of 'exploding' glass eye.

"The patient, a young man of twenty years, was sitting quietly on a screened-in-porch, reading a book. Suddenly a loud report was heard as if a pane of glass had broken, and the patient felt as if he had been struck on the head. His parents, who were present at the time, confirmed the story. Immediately he had a severe pain in his eye socket (eye not mentioned) and found it was impossible to remove the glass eye. I removed it with some difficulty and found over the stump a lacerated conjunctiva which bled considerably. The glass eye showed an irregularly broken posterior surface.

"The broken glass was recovered from within the eye. The prosthesis had been made by a reputable firm and had been worn four months."

Collado[8] reports a very interesting case, and goes much into detail. He was called to see a woman forty-one years of age. She had lost the sight of the left eye when six years of age, due to an accident. The eye was removed. She had been wearing glass eyes for the past fifteen years. One glass eye had been in use for eight years without its removal from the socket. The eye that ruptured had been in constant use for two years without ever being removed. Collado does not state why the eyes were worn constantly and not removed for cleansing. This woman, he remarks, had a malignancy of the uterus and is receiving radium treatments. She was about her regular house work when she felt what she thought was an explosion in the glass eye. The patient, when visited, was in a semi-conscious state and in severe pain. Cocain solution (strength not given) was dropped around the glass eye to find its way to the soft parts, and then he attempted its removal. The patient complained of great pain. Novocain solution 2 per cent was injected into the surrounding parts. The eye was firm in the socket and could not be budged and more solution was injected. In all, three hours were spent in removing the eye. Finally, a glass rod was used as a lever and the eye was pried out. All this was associated with great pain. It was noted that the eye was being held back in the eye socket as if some force was holding it. After removing the eye there was much hemorrhage. The glass eye was washed and it was found that a piece was broken out in the back of the eye and that the broken piece was found within the cavity of the glass eye. He was of the opinion that a metastatic process had taken place in the soft tissues in the back of the orbit and the tumor mass pressing on the back portion of the eye had broken it in, and the cause of the anchorage of the glass eye in the socket was due to the tumor mass forced into the hole in the back portion of the eye where the piece had broken out. He makes mention that he did not explore to see if there was a tumor mass in the orbit. He considered this a curious and rare case, and that perhaps no one else had experienced a similar case, and thought that he should publish it. He showed two photographs of the broken glass eye, one where the piece had broken out of the posterior surface. In reporting his case he does not make any mention if the eye showed any erosions or roughness from the secretions. This is an important point, as the eye had been worn constantly for two years without its removal.

Walker[9] published a case under the title "Artificial Eye Removed with Laryngeal Mirror" as follows: "About six o-clock on the evening of July 28, 1935, a young man, aged twenty, came running into my home, crying with pain and stating that his artificial eye had 'exploded' a few minutes previously. The day had been hot, with the temperature 101°F. throughout most of the afternoon. At 4:30 o'clock, the boy had gone into a swimming pool for an hour. As he was riding homeward in an automobile, he had heard and felt a cracking sensation in his artificial right eye. A severe cutting pain in the orbit immediately ensued, and he was unable to remove the eye. He had worn an artificial eye for six years, after enucleation following an injury. He had been wearing the eye, which caused his present complaint for eight months. He had had no similar trouble previously.

"The artificial eye seemed to be adherent to the conjunctiva lining the orbit. Manipulation in an attempt to remove it caused exaggeration of his pain. By pressure on the lateral surface of the eye, the inner edge could be seen, but could not be grasped with the fingers so as to exert strong traction. Hurriedly surveying my armamentarium for somethng to slip behind the artificial eye to aid in its removal, a small laryngeal mirror seemed suitable. I introduced this instrument at the lower inner edge of the eye, freed the conjunctiva from the posterior surface, and the eye was then easily removed.

"In the center of the posterior surface of the eye was an irregular jagged opening eight mm. in diameter. The fragments of glass had fallen into the cavity of the artificial eye, allowing folds of conjunctiva to be caught by the sharp edges of the broken glass. The conjunctiva was abraded and superficially lacerated at the site of its incarceration, but healed rapidly."

What is the cause of explosion of artificial eyes while being worn?[10] The answer is quoted in full: "From time to time there appears in the literature the account of an explosion of an artificial eye without apparent cause, while being worn. All in all, less than a dozen incidents have been reported. It is believed such explosions result from the sudden admission of air to the interior of the eye. In the process of manufacture, the air within the shell of the prosthesis is expelled by the heat to which the glass is subject while being formed. Ordinarily, the vacuum thus produced is maintained, but in some persons there is enough secretion from the socket to cause a gradual erosion of the shell. The erosion may hit a thin spot in the shell, and, when the external air pressure is greater than the strength and resistance of the glass at this area, the wall of the shell is forcibly ruptured. Usually there is no explosion, but under certain conditions that are not fully understood the sudden advent of the air under ordinary atmospheric pressure is sufficient to cause the explosion."

Hayes[11] reports one case under the title, "Collapse of Glass Eyes in the Orbit": "C. A. W. White male. Age 36. General health very good. The left eye was enucleated January 18, 1937, due to an injury. He started to use an artificial eye about the middle of March, 1937. The eye had been in use only for two months. The eye was removed frequently for cleansing. May 17, 1937, he came from a cool place and sat out in the sun to lunch (noon-time). He was sitting in the sun without a hat for about 15 minutes. He stated that he felt as if something had struck him in the artificial eye with great force, and a marked report was made that sounded to him like an explosion. He placed his hand over his eye and discovered that he had a small amount of blood on his finger-tips. He tried to remove the glass eye and it felt as if something was holding it back, like a suction in the back portion of the glass eye. During this time he suffered great pain. Finally he removed the eye, which was followed by a large amount of blood running down his face. When the eye broke he felt dazed for a few moments. I saw him about 10 minutes after the breaking of the eye. He was rather unsteady and insisted that some-

thing had struck him in the artificial eye. At this time there was considerable hemorrhage. He was placed upon a cot and finally the bleeding stopped and he regained his poise. The artificial eye was examined and a small piece was found to have broken out in the back portion of the eye, the aperture measuring a quarter of an inch in length (6 mm.) and an eighth of an inch in width (3 mm.). The socket of the eye was examined for the piece that had broken out, but it could not be found. The artificial eye was washed and cleansed, and the broken piece was then found within the cavity of the glass eye. The eye was smooth and showed no erosions. Since the breaking of this eye he has worn another, removing it only for cleansing."

Gresham,[12] of Russellville, Alabama, under date of December 23, 1938, wrote me after reading my article in Industrial Medicine on "Collapse of Glass Eyes in the Orbit" as follows: "A few weeks ago a negro man about forty called at about one o'clock in the morning. He reported to me that while he was sleeping an explosion occurred which frightened him, and with much pain he found that his glass eye had exploded. There was very slight hemorrhage and no damage to his orbit."

Behrman[13] reports under the title, "A Rare Accident to the Eye" (Non-industrial), as follows: "On April 3, 1938, Mr. G. B., while washing his face heard an explosion in his head and collapsed. When first seen the patient was sitting in a chair, utterly collapsed, holding his hand over his eye. (Eye not mentioned).

"Examination showed the glass eye to be shattered but no serious damage had apparently resulted to the surrounding tissues."

Dr. Behrman states that he took the matter up with Max Wocher Co., of Cincinnati, Ohio, a large distributor of glass eyes, and was informed that this accident is really due to a flaw in the glass; that when heat is applied the hollow glass in expanding in a rigid cavity, "explodes."

The patient informed Dr. Behrman that he had a friend who was seriously injured in a similar way.

Dr. Behrman does not state that his patient was washing his face in hot water at the time of the breaking of his glass eye, but we can take for granted that he was.

CASE REPORT

G. E. T., a white male, age fifty-four, whose general health was very good, injured his right eye eighteen years ago which resulted in its being enucleated and since that time he has been wearing a glass eye. He changes over to a new glass eye every two and one-half years, gives no reason for doing so, but just likes to make the change. He has been purchasing his glass eyes from the same surgical supply house since using them. He removes the eye about every seven days and cleanses it thoroughly. On January 20, 1944, at about 6:45 A.M., while sleeping in a room which was at 45°F., he was awakened suddenly by a terrific noise, which sounded as if an explosion had taken place and he thought that some one had fired through the window and shot him in his right eye. He stated that he was stunned and grasped his head between his hands and thought that the top of his head had been blown off. He finally moved one hand to the top of his head to see if it was all there. Later, he placed the palm of one of his hands over his glass eye. By this time his wife had turned on the light and he saw a small amount of blood in his palm when he removed his hand from over his eye. During this time he was "off balance," as he describes it, and took about five minutes to locate himself. During this time he was suffering untold pain in his right orbit where the glass eye was still in place. He tried vainly to take the eye from its socket but in this he failed. The glass eye seemed as if it was anchored in the eye socket. He described as feeling as if something was being sucked into his glass eye and the pain was unbearable. Only a few drops of blood came from the eye socket.

He was taken to the Mercy Hospital, Hamilton, Ohio, and admitted to the emergency room. He was given morphine sulfate gr. ¼ (.016 Gm.) by needle. He was now relieved of all anxiety.

The glass eye was removed by Dr. Malcolm Bronson, ophthalmologist. Six drops of ponto-

caine hydrochloride 2 per cent was instilled into the orbit around the glass eye. Two small levers were placed under the glass eye, one to the outer and the other to the inner side and the glass eye was lifted out of the orbit. It came out rather easily. A moderate amount of hemorrhage followed its removal.

Fig. 1. Glass eye showing the aperture in its posterior concave portion where the piece is broken out.

The glass eye (Fig. 1) was thoroughly cleansed and found to be smooth and showed no erosions. A piece was broken out in its posterior concave portion and found within the cavity of the eye. The aperture measured one-half inch in length (12 mm.) which ran across the long axis of the eye and a quarter-inch in width (6 mm.) across its short axis. The piece that was broken out was measured for thickness with a micrometer and found to be $\frac{1}{45}$ of an inch (.5 mm.).

At the present time the patient is none the worse for his experience and is wearing another glass eye.

The writer believes that the cause of the breaking of artificial eyes should be cleared up, either while being worn or on the shelves and whether the eye explodes or collapses. If the eye breaks, there would be a report similar to an explosion; is this report due to the eye exploding or collapsing? This would depend upon the pressure within the cavity of the glass eye. The glass eye being in the socket and surrounded by a bone wall, when breaking one can appreciate the recording on the auditory apparatus; whether it is an explosion or collapse you have the same recording.

A comparison will be made between incandescent lamp bulbs and glass eyes when being broken and the report that is recorded when they are broken and the cause of the report; whether the lamp bulb or the glass eye be hot or cold.

If two types of incandescent lamp bulbs, that is, where one bulb is well under one atmospheric pressure (one atmosphere—15 pounds) at or near a vacuum and the other bulb being well over one atmosphere (25 pounds) the bulbs being hot or cold, when broken by casting them against some object, a marked report will be recorded as if an explosion had taken place. With the bulb that is well under one atmosphere (at or near a vacuum) when broken, the report that is recorded as if an explosion had taken place is due to the outside air rushing in, which is at one atmosphere, equalizing the inside and the outside pressure. In the case of the second bulb that is well over one atmosphere when being broken, the report that is recorded as if an explosion had taken place, is due to the air rushing out of the bulb to equalize the outside pressure—one atmosphere.

If a third type of incandescent lamp bulb is used where it is at one atmosphere and when being broken against some object, the only report recorded is the breaking of the glass. No report is made as if an explosion had taken place. This is due to the atmospheric pressure being equal, that is, the same pressure inside and outside of the bulb. The same would be true for glass eyes in the orbit when broken for sound recording.

Four glass eyes in good condition, some broken glass eyes, and one glass eye that was broken while being worn, were obtained from an optical appliance company. The eye that was broken while being worn was broken in the posterior concave portion and the piece that was broken out was within the cavity of the glass eye. All of this material was sent to a very responsible laboratory so that the construction of glass eyes could be seen. A special request was made for the pressures within the four glass eyes sent. The laboratory reported as follows: Two of the four eyes were examined for internal pressures. One had

one-half and the other had one-third of an atmosphere.

The optical company from whom this material was obtained explained that the eyes were made and blown at a white heat. A glass eye about 80 per cent complete (Fig. 2) shows the globular mass with its long stem four inches in length. The stem has a capillary opening in it leading from the cavity of the globe to the outside air.

The bulb portion where the stem is attached is heated to such a degree that it is made pliable, so that when the stem is pushed forward toward the bulb the concave posterior portion of the eye is formed. During this maneuver the air that was within the bulb when it was cold was at one atmosphere. When the bulb was heated the contained air expanded and a portion of it made its exit to the outside air by way of the capillary in the stem. The eye is now completed by twisting off the stem, which now seals the eye. When the glass eye cools off at body temperature, the air that remains in the cavity of the eye contracts and the pressure within the cavity is equal to about one-half or one-third of an atmosphere. This was proved by the laboratory that examined two of four glass eyes sent them for test for internal pressure.

If a transverse cross-section is made through the mid-point of an artificial eye it will be seen that about 70 per cent of the material is in the anterior half and the other 30 per cent is in the posterior half. The anterior half needs protection, hence about 70 per cent of the material is in this portion of the eye. The posterior half is frail and thin, and being concealed well back in the socket needs no protection. It would seem that where the stem is twisted off at the time of closure would be the weak point. All the eyes that break do so in the posterior half of the concave portion, whether in the orbit or on the shelves. Only a very small percentage break, but there should be some way even to prevent this small percentage.

In the case herein reported, my previous case report,[11] and the collected cases, it will be noted that the posterior concave portion of the glass eye is the part that is always broken. Trouble is encountered in removing the eye due to the soft parts of of the orbit being sucked into the cavity of the glass eye by way of the aperture corresponding to the part that has given away. The hemorrhage is slight as long as the soft parts are engaged within the cavity of the eye by way of the aperture, also the pain is more severe. When the eye is removed the hemorrhage is more profuse and the pain markedly subsides. The piece that is broken out is found within the cavity of the glass eye after its removal.

Fig. 2. Glass eye 80 per cent complete, showing the formation of the bulb with the stem attached. There is a capillary in the stem leading into the hollow bulb.

Where the greater part of the posterior concave portion of the glass eye is shattered there is no difficulty in removing the eye as the soft parts of the orbit are not drawn into its cavity. The hemorrhage is

just as marked at the time of the breaking as when the eye is removed. The shattered parts of the glass eye are found adhered to the soft parts of the orbit after the eye is removed, and not found within its cavity.

Since the manufacturers of artificial glass eyes would not give any information as to their fabrication, one of the outstanding manufacturers of incandescent lamps was written to and asked if they could throw some light on the manufacture of glass eyes and why they broke, also what remedy or remedies could be offered to prevent the breaking.

The executive engineer replied that I had proved quite definitely that the failure of the glass eye is a collapse and not an explosion. He stated that they were not familiar with the process of fabricating glass eyes, but assumed that the closure is made with the glass close to its melting point and with atmospheric pressure inside. If this is the case, it is to be expected that the eye at body temperature would have an internal pressure of only about one-third of an atmosphere.

In his letter he stated that the following three remedies suggested themselves:

One would be to fill the internal cavity, when the glass is hot, at an absolute pressure of two atmospheres, that is, one atmosphere higher than outside pressure. This would mean at body temperature the internal pressure would be approximately one atmosphere, so that internal and outside pressures would be balanced.

The second measure, which perhaps is already employed, and which certainly should be if it is not, is to examine each eye carefully with a polariscope to detect strains and to reject all eyes which show strain.

The third measure would be to use stronger glass, if possible, than is used at present. We do not know what glass is now used, but some glasses, such as the borosilicate glasses, of which pyrex is an example, are mechanically much stronger than the ordinary lead or lime glasses.

The writer offers the following for testing out glass eyes for their weakness or frailness:

Place the glass eye in a container which can be brought up to a temperature of 130°F. and then have the eye sustain a pressure of three atmospheres (45 pounds) for a period of fifteen minutes.

The cause of the eye breaking is not due to its exploding but its collapsing. The great majority of glass eyes break during hot weather, while people wearing them are working in places of extreme heat or coming suddenly from a place that is cold to one of warmth. The heat causes the glass eye to expand and become ironed out, especially the posterior concave portion which is thin and frail; the frailest part would seem to be where the stem is twisted off to make the closure of the eye. The pressure might rise slightly within the eye above the one-third or one-half of an atmosphere. (Probably the eyes that break are the ones that are near the vacuum point.) The pressure around the glass eye is one atmosphere. Here you have a greater pressure on the outside of the glass eye than within the cavity of the eye. The concave posterior portion being the weakest and unable to withstand the outside pressure collapses and does not explode.

The glass eye also breaks in cool weather as in the case herein reported (45°F.). The orbital secretions evidently played no part in weakening the eye as it was smooth throughout and showed no points of erosions.

To prove that the eye collapses, the soft orbital tissue parts are sucked into the aperture where the piece is broken out. The smaller the aperture, the more firmly is anchored the soft part that is sucked into the cavity of the eye and this is proved by the extreme difficulty in removing the glass eye from its orbit. On examining the eye for the piece that has been broken out, this piece is found within the cavity of the glass eye, which proves that the eye collapses and does not explode. The only exception to the piece not being found within the cavity of the eye, is where the glass eye

is entirely shattered in its posterior concave portion when it collapses, and upon the removal of the eye which is very easy as it is not anchored, the broken pieces adhere to the soft parts of the orbit.

When the eye collapses there is a rushing in of air and the sound that is transmitted to the auditory apparatus sounds as if an explosion has taken place.

It is very unfortunate that all of the case reports do not give the conditions under which the eyes break. The eyes that break are frail to begin with and cannot withstand the external pressure of one atmosphere. It is very fortunate indeed that only a very small percentage of glass eyes break. From the literature, not very much stress is placed on the secretions from the orbital tissues eroding the glass eye and causing this to weaken the eye and preparing it to break.

Lewis[5] observed that the eye was smooth and showed no roughness.

McKee[6] in his case No. 2, had three eyes to break within three months.

Collado[8] makes no mention of the eye being rough, although it was in constant use for two years and not even removed from the socket for cleansing.

The writer's two cases showed no roughness of the glass eyes. They were smooth throughout just as if they had not been in use.

All the eyes referred to above that broke while in the orbit had not been in use for a long period of time, not over one year, the only exception being Collado's case.

SUMMARY AND CONCLUSIONS

The glass eye collapses and does not explode, whether hot or cold. The report made that the individual hears, and considers an explosion, is an inrush of air within the cavity of the eye when breaking. The external pressure (one atmosphere) is greater than the internal pressure (near a vacuum) causing the eye to collapse in its concave posterior portion which is the weakest point. The eye is removed from the orbit with difficulty due to the soft parts of the orbit being sucked into the cavity of the eye by way of the aperture where the piece has broken out. The smaller the aperture, the more firmly the eye is anchored and the more difficult to remove. The piece that is broken out is always found within the cavity of the eye, proving that the eye collapses.

Where the posterior concave portion of the eye is shattered at the time of the collapse, there is no difficulty in removing the eye, as the soft parts of the orbit are not anchored and the eye can be lifted right out of the orbit, also the shattered pieces adhere to the soft parts of the orbit and the piece or pieces are not found within the cavity of the glass eye.

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DISLOCATIONS OF THE SHOULDER

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THE frequent occurrence of dislocations of the shoulder makes this subject of interest to the general practitioner and surgeon alike. Acute or initial dislocations of the shoulder are common, and require not only early, non-traumatic reduction, but adequate post-reduction treatment to prevent the recurring or chronically dislocating joint. Patients suffering from recurrent dislocations of the shoulder develop a definite fear or anxiety complex, which can be relieved only by correction of the condition. With these thoughts in mind, the purpose of this article is to present a simple method of reduction of dislocations, and a corrective operation for the chronic dislocating shoulder, which have proved successful.

When the shoulder dislocates, there is not only a laceration of the joint capsule, but a stretching or sprain of the biceps tendon and its surrounding tendon sheath. At operation on recurrently dislocating shoulders, it has been noticed that there is old blood along the tendon sheath, a shallow bicipital groove and a looseness of the transverse humeral fascia and tendon sheath at the anatomical neck of the humerus. The old blood has been found several days after recent dislocations, indicating severe trauma at that point.

X-ray examinations should be made of all acute dislocations of the shoulder to rule out an accompanying fracture. Thorough *x*-ray studies should also be made before operative procedures are undertaken. When the lower border of the glenoid fossa has been fractured leaving a shallow cup for the head of the humerus, contemplated suspension operations, such as that of Nicola,[5] will be less successful. In such instances, the operation devised by Speed[6] would seem most efficacious. In recurrent dislocations in which the shoulder slips out of joint without trauma, *x*-ray examinations are not necessary prior to reduction.

In recurrent dislocations of the shoulder following the Nicola procedure, one should suspect a complete atrophy of the tendon or separation of the suture site. The atrophy which has been found may be explained by the fact that the nutritive supply which comes from the muscle belly of the biceps has been severed at operation and has not regenerated. In such cases the operation devised by Henderson[2] should be considered.

Acute dislocations, or those occurring for the first time, are reduced and treated by a body bandage and supporting sling for three weeks before motion is started. After this period of immobilization, graduated exercises are started until normal activity is reached in six or eight weeks. We have had no recurrences in patients treated in this manner. This is perhaps a coincidence, but it is believed that proper immobilization, followed by gradual use, will allow the torn capsule and tendon sheath to heal.

REDUCTION OF DISLOCATIONS

Acute or recurrent dislocations are easily reduced without trauma in the following manner. *X*-rays are taken as indicated. One-fourth gr. of morphine is given, either by the subcutaneous or intravenous route. With the patient lying supine, an assistant applies firm traction on the opposite arm, or the same force may be obtained by placing a sheet around the thorax. Gentle, constant and increasing traction is applied on the involved arm, with the elbow flexed at a right angle, the forearm being held in a vertical position. The patient is reassured and asked to breathe

deeply and relax the shoulder muscles. While constant traction is maintained, the flexed arm is gently rotated toward the

Fig. 1. Illustrates the position of the patient and the direction of forces exerted for the reduction of dislocated shoulders.

head as shown in Figure 1. The head of the humerus then slides into the joint with ease.

This method has been entirely successful in all anterior, posterior and inferior or subglenoid dislocations, and is not as traumatizing as some of the methods and maneuvers which have been advocated. This same procedure may be used with a general anesthetic, although anesthesia has not been found necessary in a successive number of either acute or chronic dislocations of the shoulder.

MODIFICATION OF THE NICOLA OPERATION FOR RECURRENT DISLOCATING SHOULDERS

The operative technic which is to be described has been suggested by Capt. H. W. Grosselfinger, who was associated with the Orthopedic Department at Strong Memorial Hospital prior to his entry into the armed forces. We have used this procedure, with some modifications, on twenty patients. Roberts[7] has described a somewhat similar procedure.

Operative Technic. A four inch incision is made from a point just anterior to the acromium process, extending distally to the lower end of the deltoid muscle. The deltoid muscle fibers are separated posterior to the path of the cephalic vein, particular care being taken to preserve the anterior branches of the circumflex humeral nerve. (Fig. 2.) This precaution prevents postoperative atrophy of the anterior portion of the deltoid muscle, although it makes the operation slightly more difficult. By rotating the arm, the bicipital groove is easily palpated and the transverse humerus ligament and the synovial sheath surrounding the long head of the biceps (bicipital tendon) are opened. The entire tendon sheath is incised along the course of the tendon, including part of the joint capsule of the shoulder. Considerable bleeding can be eliminated at this point if the circumflex humerus vessels are isolated and ligated. The tendon is then removed from the groove and retracted by a cotton tape. (Fig. 3.) By means of osteotomes and chisels, a new channel is created from a point on the head of the humerus one-half inch above the anatomical neck to the point of exit of the bicipital tendon from its sheath. (Fig. 4.) By forcing two osteotomes laterally, in opposite directions to each other, along the entire groove, a new channel approximately one-half inch deep is made in the cancellous portion of the humerus. The tape is removed, and the tendon is placed into its new groove, one-half inch in depth in the upper shaft and head of the humerus. The contraction of the muscle will hold the tendon in place, but a tension suture is placed through the

tendon and fascia at its exit from the channel to keep it taut. The joint capsule is usually redundant or excessively loose in two layers, the deltoid fascia and the skin, by means of interrupted cotton sutures.

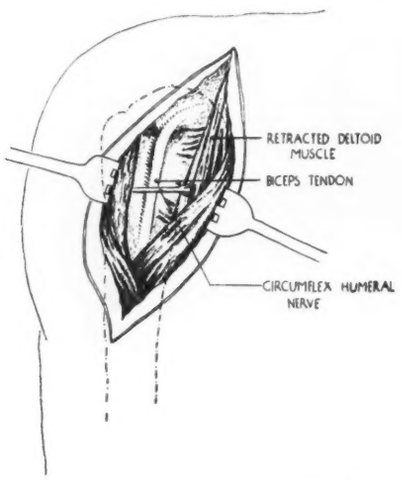

FIG. 2.

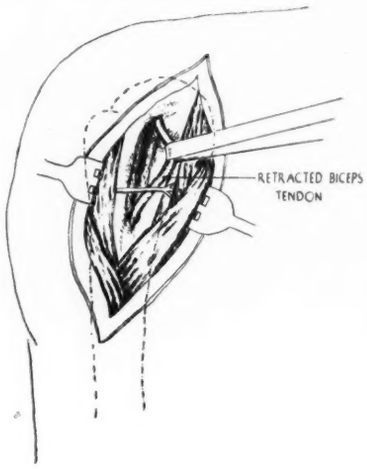

FIG. 3.

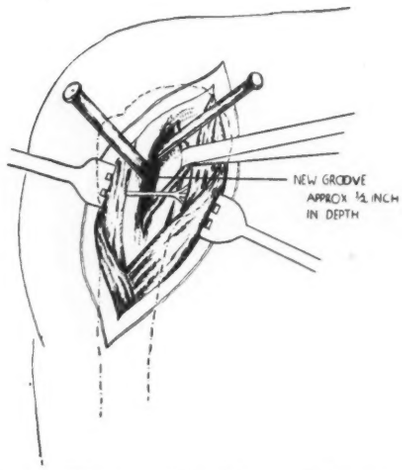

FIG. 4.

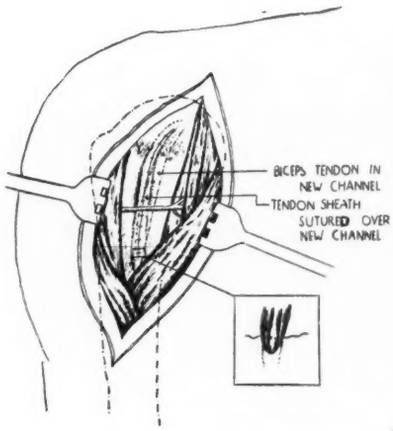

FIG. 5.

FIG. 2. The type of incision and the structures encountered, showing preservation of the circumflex humeral nerve.

FIG. 3. The tendon sheath of the biceps tendon has been incised and the tendon retracted. The joint capsule of the shoulder has been opened for a short distance.

FIG. 4. The osteotomes are shown in the new groove at the site of the bicipital depression, which should extend into the head of the humerus at least one-half inch.

FIG. 5. The transverse humerus fascia and tendon sheath are shown sutured over the new channel. Insert shows tightening suture.

along the anterior portion. Added security is obtained by freezing the joint capsule along the anterior border of the neck of the humerus and plicating it by suturing the anterior cut edge to the lateral border of the bicipital groove. (Insert Fig. 5.) The transverse humerus ligament, synovial sheath and periosteum are then sutured as one over the top of the tendon in its new channel. (Fig. 5.) The wound is then closed

POSTOPERATIVE CARE

The arm is supported by a Velpeau-type dressing, care being taken to separate opposing skin surfaces by padding. New dressings are applied weekly, and the sutures are removed on the seventh to the ninth day. After three weeks all dressings are removed, the arm is placed in a sling, and early motion is started. At four weeks,

the sling is discarded, increasing motion and physiotherapy are begun. At the end of five weeks, the patient is able to move the arm in all directions, including complete abduction and extension above the head. The only limitation after six weeks is placing the hand in the hip pocket. After adequate exercise, normal use can be expected in eight weeks. Excessive exercises are discouraged until a three-month period has elapsed.

There have been no recurrences in our series. All patients have been followed for several weeks after returning to active duty, where they have done exercises and work which had caused their previous dislocations. Two patients have been examined well over a year following their operation. Both are doing strenuous army work and their shoulders were functioning normally. One of these men was quite neurotic and apprehensive prior to operation, but has improved and developed into a useful soldier. There have been no complications resulting from the operation. One patient has been detached from the service because of neuropsychiatric reasons.

The advantages of this operation are: It is technically simple; it preserves the blood and nerve supply to the biceps tendon; it gives early and normal function and a new feeling of support and security to the previously afflicted patient.

CONCLUSION

A method for the reduction of uncomplicated dislocated shoulders, and an operation for the correction of recurrent dislocations have been presented.

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LOCAL TREATMENT OF BURNS WITH PRESSURE DRESSINGS AND FILMS CONTAINING SULFONAMIDE*

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TO date numerous methods of burn therapy have been reported. In fact, according to Harkins,[1] Whipple,[2] and McClure and Lam,[3] fifty to eighty-four different therapeutic methods have been used. In a recent treatise Whipple[2] questions the value of conclusions concerning the treatment of first and second degree burns by any of the commonly used methods. He believes that equally good results can be obtained with all of them. However, Maun and co-workers[4] and Hirshfeld and co-workers[5] are of the opinion that a number of commonly accepted regimes have caused delay in the healing of first and second degree burns because of their destructive effect on remaining layers of epithelium. This results not infrequently in the partial conversion of a second degree burn into one of third degree, perhaps with scar formation and even contracture.

With burns representing one of the major surgical problems among the casualties of this war, many new forms of treatment have been proposed, some of them making use of the various new chemotherapeutic agents, especially the sulfonamides. The use of various films as "preformed eschars" has attracted wide attention.[6,7,8] For example Whipple[2] states, "Films of several kinds, . . . when used with an understanding and appreciation of the basic principles of burn therapy, will undoubtedly prove valuable."

In this paper we wish to report on the results obtained in forty-three cases of burns of various types, which were treated with transparent films containing sulfonamides and by using pressure dressing on top of the film. In view of the limited clinical material available in our hospital we could not attempt a comparative evaluation of this method and merely wished to obtain additional evidence regarding the possible merits of the treatment described by Andrus et al.[6]

Stimulated by the late F. C. Schmelkes, work in our hospital was started about two years ago by Captain F. L. Knotts. A series of patients treated by him will be the subject of a separate report. At that time the value of local application of sulfonamides was being widely studied, the work of Meleney and others[9,10] disproving its merits had not yet been published, and the use of vaseline gauze pressure dressing had not been officially adopted.

METHOD OF TREATMENT

The film used in these cases was .004 inches thick. It was transparent, pliable, and conformed easily to body surfaces. The base of the film was methylcellulose to which was added triethanolamine in addition to a plasticizer. Although slight variations in the sulfonamide content were made in a few instances, the standard film employed contained 20 per cent sulfanilamide and 10 per cent sulfacetimide. It was estimated that 1 sq. cm. of the film contains 3 mg. of the sulfonamide. Recently ½ per cent proflavine has been added to the film content. Triethanolamine was used in this film because it maintains

*The material used in this series was obtained through the courtesy of Wallace and Tiernan Products, Inc., Belleville, New Jersey.

the hydrogen ion concentration of the surrounding medium at a slightly alkaline reaction (pH 8.5) which enhances the effectiveness of sulfanilamide.[11,12]

In accordance with the principle that burns should be considered as open wounds and treated with the utmost aseptic precaution, the following method was adopted:

1. In an attempt to control shock, either present or impending, every effort was made to make the patient comfortable by the administration of adequate doses of morphine, and by the removal of tight and heavy clothing. Plasma was given as indicated by the extent of the burn, the general symptoms, and the hematocrit value.

2. The operator scrubbed for ten minutes and wore a mask, as well as a sterile gown and gloves.

3. For the sake of evaluation of the antibacterial efficiency of the particular treatment used, a sample of the exudate was taken by means of a cotton swab and sent to the laboratory for culture.

4. The burned area was carefully cleansed with neutral soap and water for ten minutes. Pledgets of cotton were used so as not to injure the remaining epithelium. After cleansing, the area was irrigated with warm saline. All devitalized tissue was removed and large blebs excised. If the burned area was grossly contaminated, it was painted with a solution of azochloramid in triacetin (1:500).

5. Sufficient film to cover the burned area and a portion of the surrounding normal skin was then applied. If the area was exceedingly moist, a double thickness was used.

6. Gauze or cotton dressings were firmly placed over the film to act as a pressure dressing. The area was then bandaged, preferably with an elastic type bandage.

7. The superficial dressing (not the film) was removed on the fourth or fifth day for inspection of the burn through the transparent film to determine the extent of healing. For the purpose of this investigation such inspections were made as frequently as desired but the film was not removed until healing was complete. A second dressing was made a few days later unless excessive moisture, drainage, or evidence of infection necessitated earlier observation. If an area of maceration was found, a culture was taken and new film was placed over the macerated area. No attempt was made to remove the intact film at this time.

8. The film was found to peel off spontaneously after the burn had been completely epithelized, although sponging with saline or water was used occasionally to facilitate the removal.

A summary of the case histories is given in Table 1.

RESULTS

In thirty-nine cases the burns were second degree; in four cases second and third degree burns were present. Of the thirty-nine second degree burns, thirty-four were treated by cleansing with neutral soap and water, débridement, and application without cleansing or débridement.

The thirty-four dèbrided second degree burns were completely healed within four to twelve days after film application. This applied also to five cases in this category which were infected at the time of admission. In one instance (Case 23), complicated by infection with Staphylococcus aureus on admission and later by measles, forty-two days were required for complete healing. Of the five patients treated without cleansing four were completely healed within six to fourteen days (average eight and one-quarter days), and one (infected) healed in eighteen days.

The four cases of combined second and third degree burns showed complete healing of the second degree areas within fourteen days. The third degree areas healed by granulation between nineteen and thirty-two days, except in one case which required grafting.

For the sake of completeness sulfanilamide levels were taken at convenient time

TABLE I

Case	Degree and Area	Cause of Burn	First Aid Treatment	Hospital Treatment	Results
1	2° R. palm, flexor surface, all fingers	Hot exhaust pipe	Tannic acid oint. 24 hours	Cleansed, débrided, film	Complete healing 10 days
2	2° Abdomen	Scalded	Butter	Cleansed, blebs excised, film	Complete healing 5 days
3	2° Hands 6 sq. in.	Hot water, alkaline soap	No treatment for 24 hours	Cleansed, blebs excised, film	Complete healing 8 days
4	2° R. forearm 6 sq. in.	Hot pipe	Salve (?) for 2 days	Cleansed, blebs excised, film	Complete healing 7 days
5	2° Shoulders	Sunburn (severe)	None for 2 days	Blebs excised, film	Complete healing 6 days
6	2° Hands 8 sq. in.	Hot water, alkaline soap	Mercurochrome for 2 days	Cleansed, blebs excised, film applied	Complete healing 6 days
7	2° Hands 4 sq. in.	Hot water, alkaline soap	Ointment (?) for 1 day	Blebs excised, film	Complete healing 6 days
8	2° Hands 4 sq. in.	Hot water, alkaline soap	Tannic acid oint. for 1 day	Cleansed, blebs excised, film	Complete healing 5 days
9	1,2° Generalized 2° chest and thighs; 75%	Severe sunburn	None for 4 days	Blebs excised, film	Complete healing 6 days
10	2° L. hand 3 sq. in.	Hot water, alkaline soap	Tannic acid oint. for 3 days	Cleansed, blebs excised, film	Complete healing 4 days
11	2° L. hand 3 sq. in.	Hot water, alkaline soap	Noxema for 2 days	Cleansed, blebs excised, film	Complete healing 4 days
12	2° Hands 4 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 9 days
13	2,3° Head, hands, R. forearm, 30% knee, thigh	Gasoline fire, rolled on ground	Ointment-1st aid at Evac. Hosp., sent here 36 hrs. after injury	Cleansed, débrided, film	Complete healing of 2° 14 days. 3°; grafted
14*	2° R. forearm 20 sq. in.	Hot grease	Gauze	Film only	Infected. Staph. aureus lymphangitis; film used 7 days; hot compresses necessary; complete healing 18 days
15*	2° R. ankle 30 sq. in.	Stepped in boiling water	None	Blebs excised, film	Complete healing 14 days
16*	2° R. wrist 20 sq. in.	Steam, 36 hrs. before admission	Tannic acid oint. after injury. (Staph. aureus on admission)	Cleansed, film	Complete healing 6 days
17*	1° R. hand 2° L. hand 3° Thighs 10%—Total	Exploding oil can	Tannic acid oint.	Cleansed, blebs excised, film	Complete healing 1, 2° 12 days; 3° healed by granulation 32 days
18*	1° Face 2° Right hand 40 sq. in.	Exploding oil can	Tannic acid oint.	Hand cleansed, blebs excised, film	Complete healing 12 days; Pickrell's solution to face
19*	2° L. leg 10 sq. in.	Gasoline explosion	Sulfathiazole oint. 6 days; infected	Cleansed, débrided, film	Complete healing 7 days
20	2° Legs 8 sq. in.	Brush fire	Picric acid for 7 days; infected	Cleansed, compresses 5 days, then film	Complete healing 9 days
21	1° Face 2° Hands 12% Forearms	Gasoline explosion	Sulfathiazole oint. for 12 hours	Cleansed, blebs excised, film to rt. hand and forearm	Complete healing 19 days
22	1° Face 2° Hands 12%	Gasoline explosion	Sulfathiazole oint. for 3 days	Cleansed, blebs excised, film, Pickrell's solution to face	Complete healing 8 days

TABLE I (*Continued*)

Case	Degree and Area	Cause of Burn	First Aid Treatment	Hospital Treatment	Results
23	2° L. leg 20 sq. in.	Fire	Sulfathiazole oint., six days infected. (Staph. aureus)	Cleansed, compressed, 3 days, then film	*Developed measles; infection persisted (Staph. aureus) healing 42 days
24	2° Fingers 3 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 8 days
25	2° L. forearm 18 sq. in.	Scalded	None	Cleansed, blebs excised, film	Complete healing 6 days
26	2° Hands 4 sq. in.	Hot water, alkaline soap	None	Cleansed, blebs excised, film	Complete healing 6 days
27	2° Hands 3 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 12 days
28	2° Hands 4 sq. in.	Hot water, alkaline soap	None	Cleansed, blebs excised, film	Complete healing 5 days
29	2° Hands 3 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 6 days
30	2° R. hand 2 sq. in.	Hot water	None	Cleansed, blebs excised, film	Complete healing 4 days
31	2° R. hand 4 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 5 days
32	2° R. hand 2 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 8 days
33	2° R. hand 2 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 11 days
34†	2° Legs 56 sq. in.	Cement (wading in cement)	Ichthyol oint. for 1 day, sulfathiazole oint. for 3 days, (infected Staph. aureus)	Cleansed, compresses for 5 days, then film	Complete healing 8 days
35†	2° Legs 60 sq. in.	Cement (wading in cement)	Ichthyol oint. for 1 day, sulfathiazole oint. for 3 days, infected	Cleansed, compresses 4 days, then film	Complete healing 8 days
36†	2° L. hand; all fingers	Exploding cigarette lighter	None	Cleansed, blebs excised, film	Complete healing 9 days
37	2° R. hand, 3 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 9 days
38	2,3° L. ankle 50 sq. in.	Stepped in boiling eggplant	Boric acid oint. for 2 hours	Cleansed, blebs excised, film	Complete healing 2° area 14 days; 3° areas infected; healed 23 days
39	2° Hands 4 sq. in.	Hot water, alkaline soap	None for 1 day	Cleansed, blebs excised, film	Complete healing 5 days
40	2° R. hand 4 sq. in.	Hot water, alkaline soap	Blebs punctured with pin 7 days ago	Cleansed, blebs excised, film	Complete healing 7 days
41	2° Hands 4 sq. in.	Hot water, alkaline soap	Not any for 1 day	Cleansed, blebs excised, film	Complete healing 6 days
42	2° L. hand 3 sq. in.	Hot water, alkaline soap	Not any for 2 days	Cleansed, blebs excised, film	Complete healing 7 days
43	2° Hands 8 sq. in.	Hot water, alkaline soap	Not any for 1 day	Cleansed, blebs excised, film	Complete healing 8 days

* These patients were treated with a film containing 10 per cent sulfanilamide only.
† The film used in these cases contained ½ per cent proflavine as well as the sulfonamides.

intervals during the course of treatment. These were found to vary according to the size and depth of the burn from a trace to 8.5 mg. per cent, expressed as sulfanilamide equivalent. In one case (No. 13) sulfanilamide determinations were made on three subsequent days after a single application of the film and showed blood levels of 7.6, 7.1, and 8.5 mg. per cent, respectively. This indicates a slow resorption since sulfonamides were still being absorbed approximately seventy-two hours after application. This observation agrees with that of Hare and Clark,[13] who found that embedding of sulfonamides in methylcellulose retards absorption considerably. Toxic reactions due to sulfonamides were not seen in any of these cases.

COMMENTS

When this study was started, the topical use of sulfonamides for prevention of wound infections was widely accepted. Since then the value of locally applied sulfonamides in the treatment of burns has become doubtful,[10] although Whipple[2] believes that the local use of sulfonamides in the treatment of burns shows promise and states, "The benefits of these amazing drugs will depend upon finding their optimum ionization and pH in proper media."

We can safely conclude from the results obtained in this series that the healing time with this treatment compares favorably with most of the accepted methods of therapy. The film appears to possess an outstanding advantage in that it forms a protective transparent coating which is not removed until full healing has occurred. Painful redressings are thus eliminated and injury to partially devitalized structures and fragile newly growing epithelium is prevented. Contamination was reduced to a minimum in our series. Observation of strict aseptic precautions and application of pressure dressing were undoubtedly responsible for the good results obtained and in the light of recent knowledge it is doubtful whether the sulfonamides in the film were of any benefit.

Our experience essentially confirms that of Andrus, et al.[6] in that we find that the film can be most conveniently used in combination with pressure dressing. We also believe that in some emergencies and on the battlefield it is of advantage because it can be distributed with a minimum of bulk yet in sterile form.

SUMMARY

Results obtained with a simple method of local treatment of burns consisting of the application of a transparent hydrophilic film containing approximately 30 per cent sulfonamide, and of pressure dressing have been reported. The film can be applied easily and by virtue of its transparency, periodic inspection of the burned area is possible without disturbing the lesion. It can be used conveniently under a pressure dressing so that full advantage is taken of this well recognized method for suppression of lymph flow. The sulfonamide in the film did not seem to delay healing noticeably. The immediate relief of pain after application and the favorable rate of healing obtained in these cases suggests that the method of therapy described is worthy of further consideration.

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It should be the aim of every medical man to treat cases of burns in such a way that a minimum amount of scar tissue is produced in the healing processes. The mortality rate due to burns varies with the area of the burn; it is the extent of the burn rather than the depth which endangers life. If more than a quarter of the surface area of the body is burnt there is a serious threat to life.

From "Surgery of Modern Warfare" edited by Hamilton Bailey (The Williams and Wilkins Company).

Case Reports

BIZARRE TYPES AND LOCATIONS OF LIPOMAS*

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WE should like to direct attention to some unusual types of these simple, common tumors, and to peculiar locations where they occur and simulations that they make. Brief case reports illustrate the salient features of each type and group.

Lipomas are one of the most common tumors. They may occur anywhere on the body and may even cause death by growth and pressure on vital organs.[1] These tumors develop more frequently in women than men (3 to 2)[1] and they occur chiefly between the ages of twenty to fifty years.[2] Certain regions of the body are frequent sites of lipomas, as for example, the back of the neck, forearms, axilla,[1] buttock and upper thighs[2] and they seldom occur in the face, scalp, legs, and inguinal region.[3] Adair, Pack, and Farrior, in a series of 134 patients studied, found 6.7 per cent had multiple lipomas. In a simple classification, these observers devised three groups of lipomas: (1) subcutaneous, (2) intermuscular, and (3) visceral. Lipomas transilluminate and those in the breast sometimes present a very special problem.[1] Radiographic studies of deep lipomas frequently yield valuable information according to Brown and Grollman. Nicolas Tagliavacche was among the first to make a preoperative roentgenologic diagnosis of lipoma.[4] Silberman, Hunt and Bisgard, and Templeton have contributed further information of value in the preoperative diagnosis of lipomas by radiographic means.

Malignant changes in lipomas and their combination with other tumors as fibromyxolipoma, etc., do not come within the scope of the study.

LIPOMA ASSOCIATED WITH AND SIMULATING HERNIA

Lipomas occasionally occur in the inguinal and femoral canals and simulate hernias or occur associated with hernias. Watson, in 1935, discussed such tumors. He noted that they are usually attached to the spermatic cord or sac (if one is present) near the internal ring. The diagnosis in these cases is the most difficult, especially if the tumor appears suddenly after a strain with pain, nausea, and vomiting.

Not infrequently these lipomas are diagnosed as hernias and the patient is advised to wear a truss and frequently does. At times the pressure of the truss on the lipoma makes it tender. Occasionally, the lipoma may strangulate and appear exactly as a strangulated hernia. Muzzarelli reported a lipoma of the left inguinal region of a man, aged sixty-six years. At first this swelling was walnut size. It gradually increased and was as large as a turkey egg when he was admitted for examination. A diagnosis of hernia had been made and for two years the patient had worn a truss. After examination Muzzarelli made a diagnosis of a direct inguinal hernia containing omentum. Surgical intervention under local anesthesia revealed a multilobulated lipoma

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in the inguinal canal attached to the peritoneum by a fine cord. The author speculated as to the explanation for the development of the lipoma and symptomatology.

We have had two cases of a lipoma simulating a hernia and two of a lipoma associated with a hernia.

CASE REPORTS

Case I. V. B., a schoolteacher, aged twenty-two years, was admitted to the Clinic Hospital as an emergency. She complained of a pain and mass in her left groin and thigh. Ten days before her admittance, after she had lifted some baskets of fruit in her father's store, she had noticed soreness in her groin and had felt a "lump" there. On the evening of her admittance while playing volley ball at her school she again had a pain in the groin and thigh. She felt a "lump" again. This time the mass was very tender. She was nauseated but did not vomit.

Physical examination revealed a well nourished, acutely ill young woman; blood pressure 120/80; pulse 80 and temperature 98.0°F. The most important physical finding was a mass about 4 cm. in diameter in the left groin just below Poupart's ligament. The femoral artery seemed to be lateral to the mass. Attempts to press the mass back into the abdomen were painful and unsuccessful. A single urine examination revealed a specific gravity of 1015, acid reaction, no albumin, few pus cells. Blood examination was as follows: Hemoglobin 93 per cent Sahli; erythrocytes 4.47 million; leukocytes 10,500; Mazzini negative.

A tentative diagnosis was made of a strangulated femoral hernia and immediate operation was offered and accepted by the patient.

Operation was performed at the Clinic Hospital under cyclopropane—oxygen anesthesia. The incision was made parallel to Poupart's ligament. The hernia sac was found and isolated above and below the ligament. The abdominal cavity was opened and the sac inverted, ligated and removed. It measured approximately 3 by 2 by 1 cm. A small bit of omentum had been strangulated in the hernia sac. The omentum involved was not gangrenous although its blood supply had been somewhat interfered with. The aperture which was the site of the herniation was closed by No. 2 chromic sutures extending from Poupart's ligament to the pectineus muscle. In the thigh superficial to the femoral hernia was a lipoma 4 by 3 by 2 cm. This was removed. This lipoma was the mass felt before operation and assumed to be a strangulated femoral hernia.

The patient left the hospital with her wound completely healed fourteen days after the surgical procedure.

Case II. *Lipoma Simulating an Inguinal Hernia:* R. C., aged forty-eight, married, a farmer, came to the clinic complaining of recurring "nervous breakdowns" and heart trouble. In the course of his examination a soft mass was found protruding from the right external inguinal ring. This had been present many years. The patient volunteered the information that he had been told this was a hernia by many doctors and at one time had worn a truss on the mass with no effect. One of his physicians had suggested that this might be a "fat tumor." Laboratory data revealed: Urine specific gravity 1017; acid reaction; no significant microscopic findings. hemoglobin 99 per cent Sahli; erythrocytes 4.31 million; leukocytes 6700; Mazzini negative; blood pressure 90/68; pulse 90 and irregular. Electrocardiographic studies revealed an auricular fibrillation. A diagnosis of chronic nervous exhaustion, hypotension, and auricular fibrillation was made and the patient was under medical management for some weeks and showed clinical improvement. He then suggested that he have the hernia investigated. A lipoma of the inguinal canal was suspected.

Operation was performed at the Clinic Hospital under cyclopropane—oxygen. The incision was made parallel to Poupart's ligament and extended from near the symphysis almost to the anterior superior spine of the ilium. There was a fatty sac-like mass 5 by 3 by 2 cm. extending through the external ring. The fascia of the external oblique muscle was split parallel to its fibers and 4 to 5 cm. above the internal ring. A large mass of fat filled the inguinal canal. At first it seemed that this was a hernia sac filled with omentum but careful dissection revealed the mass to be a lipoma 22 by 12 by 3 cm., filling the inguinal canal and extending through the external ring. The lipoma was dissected from the cord and adjacent structures. (Fig. 1.) Exploration of the femoral canal revealed no hernia.

The spermatic cord was transplanted subcutaneously and an imbrication type of closure made using No. 2 chromic catgut. The operation was easily accomplished after

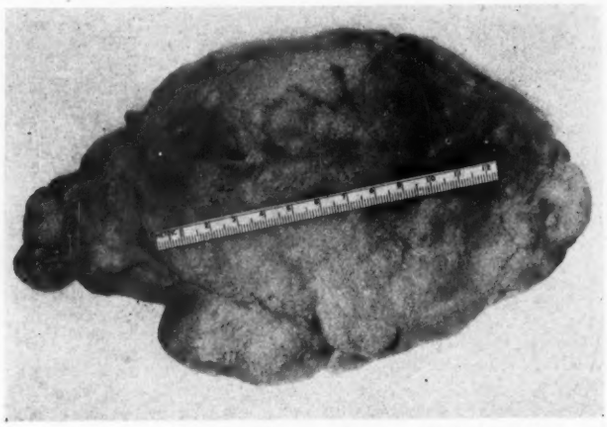

Fig. 1. Case I. Lipoma; the portion to the left of the end of ruler marked metric extruded through external ring. The remainder of tumor was in inguinal canal.

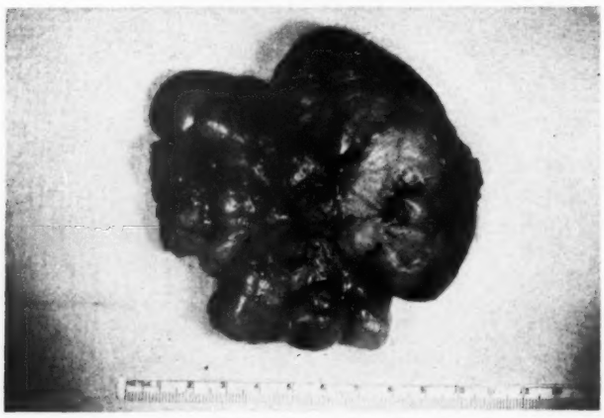

Fig. 2. Case III. Lipoma; the lobule of tumor closest to ruler extruded from external inguinal ring.

structures were identified and the true situation disclosed. The skin was closed with nylon. The patient was a risk 2 because of auricular fibrillation. The patient led an uneventful convalescence and left the hospital in twenty days with the wound healed.

Case III. *Lipoma Simulating Hernia:* E. C., machinist, aged forty-eight years, married, the father of two living children, came to the clinic complaining of psoriasis, present for twenty-two years, and a tumor of the right groin present for two years. This mass in the right inguinal region was first noticed as a small "kernel" which had gradually enlarged to the size of a small orange. This mass was not tender but it did "bother" the patient when he walked and especially when he would bend forward. One physician had told the patient this was a "rupture" and the patient had worn a truss for some months with no effect on the lesion.

Physical examination revealed the following: weight 170 pounds; blood pressure 150/110; pulse 88; temperature 98.0°F. There were many red macular scaling lesions on the trunk and extremities (psoriasis) and a soft tumor in the right groin about 10 by 5 cm.

Laboratory examination of the urine revealed: specific gravity of 1028, acid reaction, no sugar or albumin and an occasional pus cell. The blood examination revealed: hemoglobin of 82 per cent (photolometer); erythrocytes 4.2 million; leukocytes 9800, Mazzini negative.

A tentative diagnosis was made of an indirect inguinal hernia with omentum in the sac or a lipoma of inguinal canal. An exploratory operation was advised. The patient accepted.

Operation was performed at the Clinic Hospital under cyclopropane-oxygen anesthesia. The incision was made parallel to Poupart's ligament. The fascia of the external oblique muscle was incised parallel to its fibers and a lipoma measuring 13 by 8 by 4 cm. was found. A portion of the lipoma extruded through the external inguinal ring but most of the tumor was in the inguinal canal. (Fig. 2.) One tongue of lipoma extended down toward the thigh. The incision in the fascia was closed with No. 2 chromic gut and the skin was sutured with nylon.

This patient's convalescence was uneventful and he left the hospital within two weeks with his wound completely healed.

Case iv. *Lipoma Associated with Epigastric Hernia:* R. G., aged thirty-nine years, married, a farmer, came to the clinic complaining of a "lump" in the middle of his abdomen about halfway between the naval and the xiphoid. The knot had been present for sixteen years. At first the nodule was about the size of the end of the finger but it had gradually enlarged until at the time of his examination the tumor was about 4 by 3 by 3 cm. Soon after the tumor was discovered the patient had gone to a physician who told him this was a fat tumor and to leave it alone unless it caused symptoms. During the last two months when the patient would lift, he would have a sharp pain in the "lump" and he would have to bend forward before he could get relief. In the past two years the lesion had doubled in size. The only other complaint the patient had was multiple attacks of appendicitis.

Physical examination revealed a well nourished partly gray-haired man, blood pressure 124/84; pulse 72; temperature 99.0°F. The pertinent point in the physical examination was a mass 3 by 4 by 3 cm. in the midline approximately halfway between the umbilicus and the xiphoid process. The opening in the fascia was about 1 cm. in diameter. Palpation of the sac revealed lobulated substance that felt like fat, probably of the omentum. This fat could not be pushed back through the hernia opening into the peritoneal cavity. There was also tenderness in the right lower quadrant of the abdomen near McBurney's point. Urine: specific gravity 1021, acid reaction, no sugar, albumin, or casts. Blood examination revealed hemoglogin 90 per cent (photolometer); erythrocytes 4.52 million; leukocytes 7250.

A diagnosis was made of an epigastric hernia probably containing omentum and chronic recurring appendicitis. Surgical therapy for both conditions was offered and accepted by the patient.

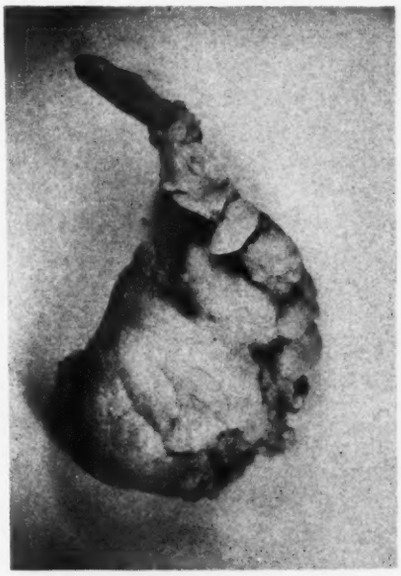

Fig. 3. Case v. Lipoma simulating thyroglossal duct. The long tongue of tissue extended upward toward hyoid bone.

Operation was performed at the Clinic Hospital under cyclopropane-oxygen anesthesia. A midline incision was made through the skin and the mass was visualized after dissecting the skin flaps backward. The mass proved to be a lobular lipoma about 4 by 3 by 3 cm. and attached to this was the sac of an epigastric hernia. The opening of this hernia in the fascia was about 1 cm. in diameter. The fascia was incised and the neck of the sac isolated and cut off. There was omentum in the sac. The fascia at the edges of the lipoma was very thin. The sac was excised together with the lipoma. The peritoneum was closed with No. 1 plain catgut. The fascia layers were dissected backward and then closure of the fascia made by imbrication with No. 2 chromic catgut. The closure was adequate. The skin was closed with nylon. Through a McBurney incision a chronically inflamed appendix was removed.

The postoperative course of this patient was uneventful except that there was an accumulation of serum in the subcutaneous tissues of the hernioplasty. The patient left

the hospital on the fourteenth postoperative day.

Case v. *Lipoma Simulating Thyroglossal Duct Cyst and Sinus Tract:* J. O. H., a farmer aged forty-nine years, married, the father of ten living children, came to the clinic complaining of "fainting spells" and a "lump" in the front of his neck. The fainting spells had been present about six months. These attacks were associated with dimming of vision, bad taste, and dry mouth. If the patient could lie down when he felt this aura, the episode might pass off, otherwise, the patient would give a cry, be unconscious for five to ten minutes, froth at the mouth and usually sleep for half an hour after the seizure passed.

The lump in the front of the neck below the Adam's apple had been present for a year or two. It had gradually enlarged and the patient was conscious of it when he "dressed up for Sunday" and wore a tight collar. The lesion had gradually enlarged and moved up and down when he would swallow.

Physical examination revealed a slender man; blood pressure 108/80; pulse 60; temperature 98.0°F., urine: specific gravity 1017, alkaline, 2+ phosphates, 1+ pus cells; blood: hemoglobin 81 per cent Sahli, erythrocytes 3.85 million; leukocytes 5950, blood urea 48, blood sugar 75, basal metabolic rate −7 per cent; blood Kline-negative. There was a soft mass in the front of the neck just above the thoracic aperture. This mass was between 2 and 3 cm. in diameter. When the patient swallowed this nodule moved for it was apparently attached to the trachea.

A tentative diagnosis was made of idopathic epilepsy and an uncertified tumor of subcutaneous tissues of the front of neck either a thyroglossal duct cyst or lipoma.

Appropriate medial management was inaugurated for the epilepsy and operative removal of the lesion in the neck planned.

Operation was performed at the Clinic Hospital under 2 per cent novocain infiltration anesthesia. A Crile modification of the Kocher incision was used. When the platysma muscle and superficial cervical fascia were incised, a lobular lipoma was discovered on the isthmus of the thyroid gland and trachea. This lipoma, which was about 2 cm. in diameter, was freed from adjacent structures and these included the strap muscles, the anterior jugular vein and the trachea. There was a tongue of this lipoma about 3 cm. long which extended upward on the trachea and larynx to the level of the hyoid bone. (Fig. 3.) The whole dissection was carried out under local anesthesia. The bleeding points were ligated and a rubber dam wick was left in the fossa. The skin was closed with clips. Two days after the operation the drain was removed and four days postoperatively the patient went home to return later for removal of skin closure.

Case vi. *Lipoma Causing Pressure Symptoms:* W. W. R., auditor, aged forty-nine years, married, father of five children, came to the clinic complaining of numbness for six months in his right forearm and hand near the thumb and first finger, and a tumor on top of the right shoulder present for three or four years. The past history, so far as diseases were concerned, was unimportant. The distress in the hand and arm would come on as he sat working at his desk and as the day passed the distress increased.

The tumor on top of the shoulder had gradually enlarged until he would notice pressure on it from his suspenders or vest, or tight underwear, or strap of bathing suit.

Physical examination revealed a well nourished man; blood pressure 126/78; pulse 74; temperature 98.6°F.; urine: specific gravity 1020, acid reaction, occasional pus cells, negative for sugar or albumin; blood study revealed hemoglobin 82 per cent Sahli, erythrocytes 4.2 million, leukocytes 6540.

The most interesting feature of physical examination was a soft tumor about 2 to 3 cm. in diameter, apparently just under the superficial fascia of the right shoulder. The tumor was in the groove between the top of the shoulder joint and clavicle, just where pressure by a suspender strap or underwear would normally come. Palpation revealed tongues of tissue which seemed to go backward under the trapezius muscle and anteriorly under the clavicle. Neurological examination revealed no cause for the numbness complained of and it was doubtful if the tumor could cause the distress. The patient was convinced that the tumor was the cause of the numbness and insisted that if we did not excise the lesion he would "go to someone who would."

Operation was performed at the Wells County Hospital under ethylene oxygen anesthetic. The incision was made anteroposterior over the top of the shoulder and tumor. When the superficial fascia was incised a lobulated

lipoma "popped up." This portion was about twice the size of the palpable portion before operative interference. Tongues of the tumor extended backward and downward under the edge of the trapezius muscle and forward and downward under the clavicle. The dissection was tedious but the tumor was apparently all removed. The greatest dimensions of the tumor were approximately 8 by 6 by 3 cm. A rubber dam drain was inserted into the space formerly occupied by the lesion. Closure of the skin was made with dermol. As soon as the patient awakened he noticed no numbness and when he left the hospital, five days later, he still was free of any symptoms of numbness in the hand and forearm.

Case vii. Mrs. A. J., aged thirty-nine years, married, mother of two children, a factory worker, complained of tumors of each buttock and pains radiating down legs. The patient had these masses near the gluteal folds for many years. They had gradually enlarged but gave no symptoms except for their presence. About six months before coming for examination, the patient began to work at a factory and in the course of her work she sat on a hard stool or chair. She soon noticed pain radiating down the back of her thighs and in her buttock. The tumors of the buttocks became tender and the more she sat the more severe and disturbing became the pain down the legs. From this distress she sought relief.

Physical examination revealed the following: blood pressure 130/90; pulse 80; temperature 98.6°F.; urine: specific gravity 1012, acid reaction, no albumin, no sugar, occasional pus cells; hemoglobin 75 per cent Sahli; erythrocytes 3.75 million; leukocytes 4600. The pertinent features of the physical examination were tumors of each buttock near the gluteal line. These lesions were each approximately 15 by 5 cm. in their greatest dimensions. Since no other source could be found for the distress the patient was advised to have the tumors removed and she accepted.

Operation was performed at the Clinic Hospital under cyclopropane-oxygen anesthesia. Incisions were made over the lipoma in each buttock and they were each removed by blunt and sharp dissection. Some portions of the lipomas were encapsulated, others were not. Sharp dissection was required to free them from their attachment to the subcutaneous fat and gluteal muscles. Both lipomas were about the same size and their average dimensions were 15 by 10 by 5 cm. Cigarette drains were inserted in the space left by the lipoma and the subcutaneous tissue was drawn together with No. 0 plain catgut. The skin was closed with interrupted nylon sutures. The drains were removed in two days and the patient was able to leave the hospital on the eleventh postoperative day. The patient returned in one and two months and said that she was free from pain down her legs and thighs.

COMMENT

Lipomas simulating hernias are most disconcerting and difficult to diagnose, and their true identity is not always established until a surgical procedure is performed. When lipomas occur, associated with hernias, the situation is most baffling and when a lipoma occurs with a strangulated hernia, the acme of disconcertion is attained in this set of circumstances.

It seems reasonable to suppose in some cases that a lipoma may have caused pressure on fascia sufficient to thin it and with the lipoma as the wedge to force herniation through fascia planes (Case iv) or through an inguinal ring. The simulations of lipomas are most curious, aping of hernia and of a thyroglossal duct cyst.

The pressure symptoms are the least intriguing of the whole group but one cannot disregard lipomas as cause of referred pains, particularly along the extremities.

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DIVERTICULOSIS AND DIVERTICULITIS OF THE COLON

CASE REPORT OF A FOURTEEN YEAR OLD PATIENT

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THIS case is reported because of the age of the patient (he was fourteen years old when it was first discovered that he had diverticulosis) and because he has been under my care for twelve years.

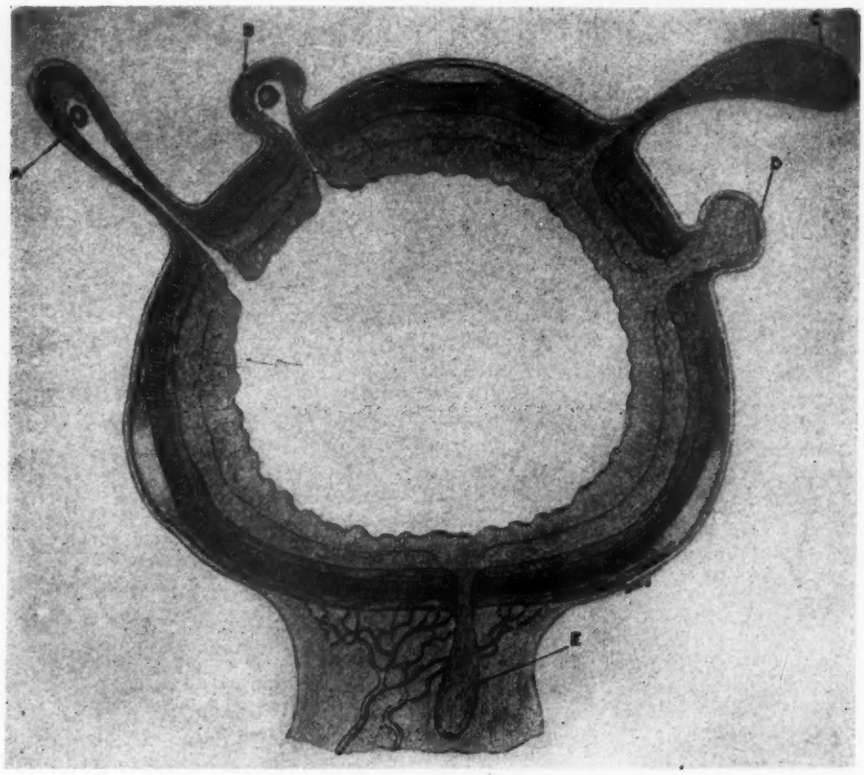

FIG. 1. Various forms of diverticula: A, true diverticulum in epiploic appendix with foreign body; B, true diverticulum with foreign body; C, false diverticulum in epiploic appendix; D, false diverticulum; E, intermesenteric diverticulum. (From ERDMANN, J. F. Diverticulitis and diverticulosis. *J. A. M. A.*, 99: 1125–1128, 1932.)

Diverticulosis is a condition in which many diverticula exist in any portion of the intestine, usually the colon.

In the second half of the nineteenth century some investigations were conducted on the subject but the information was not conclusive. It was only at the beginning of the present century that Edwin Beer, W. J. Mayo, Moynihan et al. began to give to the medical world the true import of diverticula in the alimentary canal. Since then, the literature on the subject has become quite voluminous with reports based on clinical and pathological studies so as to assure a clearer interpretation of the symptoms both for diagnosis and for treatment. As the roentgen rays became more widely used in the study of the alimentary tract, the radiologists, about 1914, began to give an account of

their observations. Since then the diagnosis of uncomplicated diverticulosis has depended a great deal upon radiographic evidence.

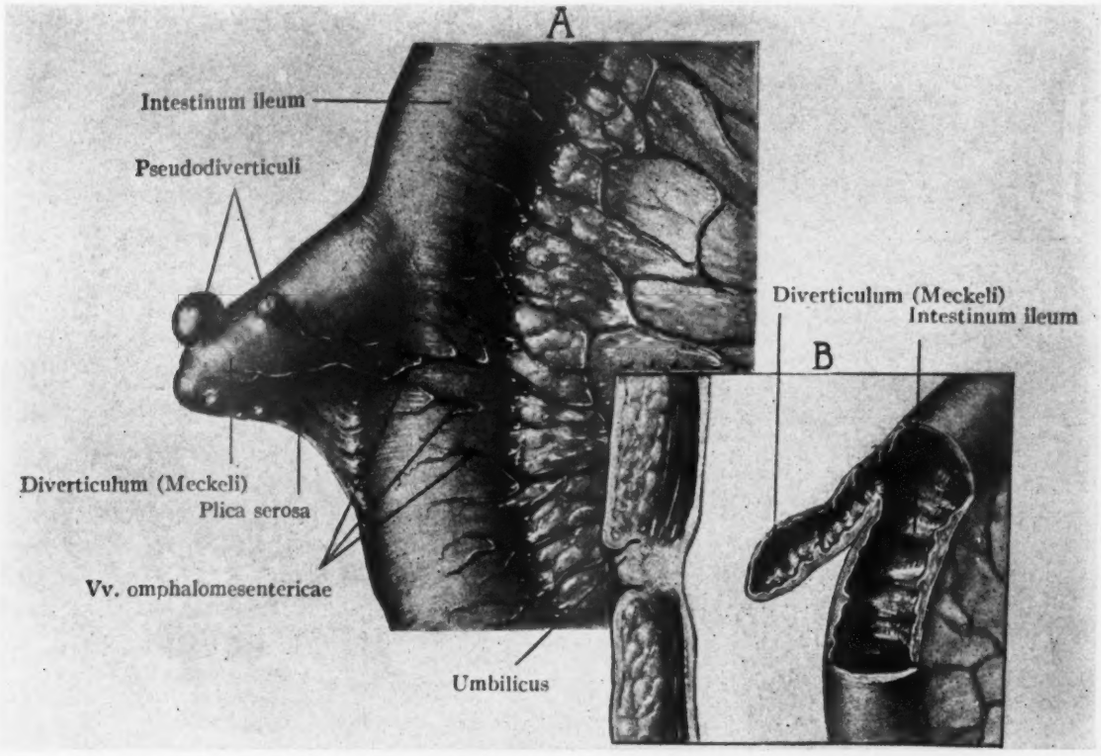

FIG. 2. Ileal diverticulum (of Meckel). A shows the diverticulum along which lie the omphalo (vitello)-intestinal vessels; B shows a section removed from the ileum and from the diverticulum. (After Cullen.) (From CALLANDER, C. LATIMER. Surgical Anatomy. 2nd ed. Philadelphia, 1943. W. B. Saunders.)

Definition. Diverticula are pouch-like protrusions from the alimentary canal. They are herniations of areas of the mucosa and submucosa, through interstices in the muscle coat, Blowouts of the inner tube (mucosa). In the intestine they form projecting-like sacculations and may occur on the mesenteric side; they may be antimesenteric or may occur on the lateral wall. In the colon they may develop into parallel rows on either side of the mesocolon.

Types. Diverticula may be true or false. A true diverticulum (Meckel's) is one that has all the coats of the intestine. A false diverticulum is one which has all the coats minus the muscularis. The term diverticulosis denotes the presence of sacculations of various sizes protruding from the lumen of the bowel through the mucosa and submucosa, having a peritoneal covering. The onset of an inflammatory process in any of these sacculations will create a definite clinical entity called diverticulitis. Some observers have pointed out that diverticulosis is the most common pathological lesion of the colon and that it is responsible for the majority of cases of disease of the colon sent to the surgeon or to the radiologist. However, this opinion is not shared by all investigators.

Meckel's Diverticulum. This diverticulum is a true congenital diverticulum due to the persistence of the proximal portion of the omphalomesenteric duct which normally atrophies a few weeks after birth. It is found in about 2 per cent of individuals. It varies up to 30 cm. in length but is usually about the size of a small finger. It is situated one to three feet proximal to the ileocecal junction. They are a common source of melena in infants and children. It may cause volvulus or intususception. This diverticulum is always a source of danger in the abdo-

men because of its tendency to create intestinal obstruction.

Etiology. Several hypotheses have been offered to explain the cause of formation of these protrusions. But so far they remain simple theories and the subject is still under discussion. Some investigators maintain that in the obese and asthenic individuals they develop in middle life and are produced by increased intracolonic pressure caused by constipation and frequent drastic cathartics. Others attribute the formation to a process of aging, senile changes, like gray hair and the rugae of the skin, so that in like manner the intestinal wall goes through a process of deterioration of the muscularis creating a weakness in the muscular wall.

Graser believed that the sacculations formed by following the course of the emerging veins as they reach the serosa through the intestinal wall.

Klebs maintained that the protrusions occurred in relation to points of entry and exit of blood vessels along the mesenteric attachment, believing that the intestinal wall is weak at this point.

Since the false types are of the acquired variety they must be of the pulsion type, and because they occur at any age and appear anywhere in the intestinal tract one is led to believe that a locus minoris

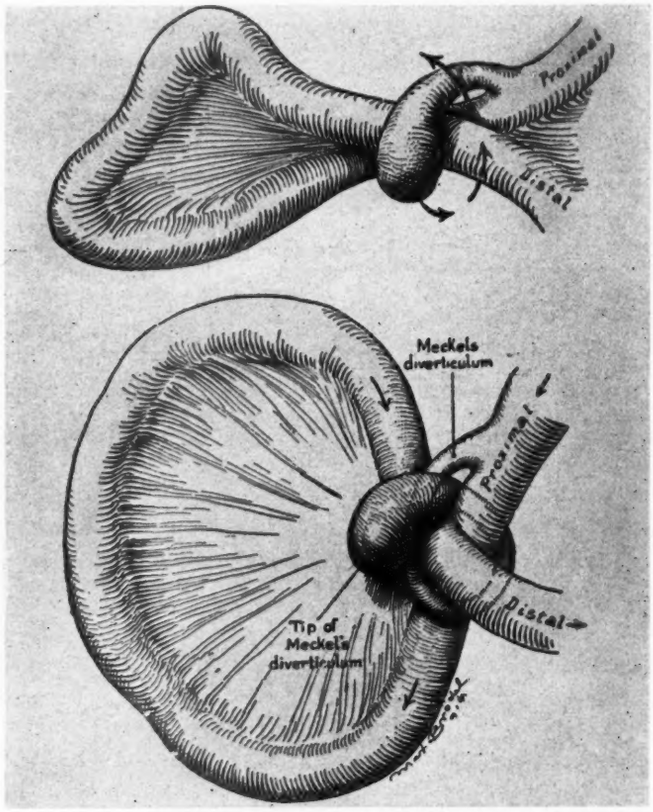

FIG. 3. A diverticulum tying off a loop of small bowel. This indicates the manner in which the obstruction occurred; a Meckel's diverticulum has dropped over a loop of bowel which has been twisted; after passing under the loop, the diverticulum curves upward and passes through the space between the base of the diverticulum and the adjacent small bowel; there is consequent distention of the constricted bowel and complete obstruction has resulted. (Cullen.) (From CALLANDER, C. LATIMER. Surgical Anatomy. 2nd ed. Philadelphia, 1943. W. B. Saunders.)

resistentiae is congenitally present in the muscularis. Thus, with a congenital weakness in the muscular coat and with increased intracolonic pressure, such as caused by constipation, these forces can be the exciting factors. The theories of Klebs and Fraser seem to be fallacious because diverticula are found (the double row observed in the colon) in points which have no relation to blood vessels. While there is no unanimity of opinion as to the cause of production of these sacculations and because they appear at any age, it seems safe to assume and agree with Erdmann that a congenital weakness must exist in the intestinal wall. This congenital abnormality is felt more with advancing years when muscular tone is diminished not only in the alimentary canal but as a process of aging is shared by the entire body.

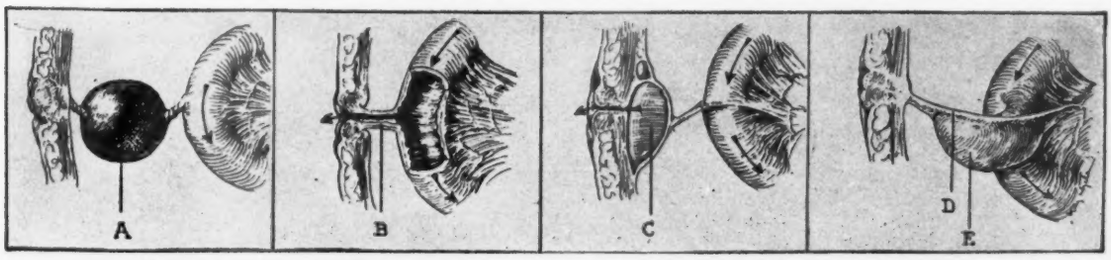

Fig. 4. Varieties of omphalo (vitello)-intestinal pathology. A, cyst caused by torsion of the omphalomesenteric duct; B, patent omphalomesenteric duct; C, cyst of the umbilicus, the result of a remnant of the omphalomesenteric duct; D, fibrous cord from omphalomesenteric vessels; E, Meckel's diverticulum. (After Cullen.) (From Callander, C. Latimer. Surgical Anatomy. 2nd ed. Philadelphia, 1943. W. B. Saunders.)

Distribution. Diverticula occur in any part of the alimentary tract, from the esophagus to the rectum. They are most common in the sigmoid. Eighty-five per cent involve this part of the bowel; the other 15 per cent are shared by the transverse, rectum and descending colon progressively. They are rarely found in the cecum, ascending colon and in the appendix. Diverticula of the large intestine are all of the false type. They may be single or may be present in hundreds; as many as 400 have been found. They may be small or may reach the size of a small plum seed. The appendix presents an incidence of 1.89 per cent. They occur between the layers of the meso-appendix like small buds and are frequently multiple.

Age. Reports indicate that they occur in 5 per cent of all subjects over forty. Most occur after middle life. Some have been reported to occur much earlier. J. Erdmann reported a patient under seven years of age. Race plays no important rôle. Males seem to be affected in a ratio of 2:1 compared with females. At the Mayo Clinic only twenty under forty showed diverticulosis out of 1.819 patients. In his report John Erdmann stated that he, during the course of operation, observed the presence of diverticula scattered through the small as well as the large intestine.

Symptoms. Uncomplicated diverticulosis is symptomless. Diverticula sometime aggravate the already existing constipation and increase intestinal toxemia. In the cecum, ascending colon and part of the transverse colon, the feces are in a semi-soft state, but in the left colon, sigmoid and rectum, the water has been absorbed and the feces become harder. Here, stasis is usually present, putrefaction is greater and the formation of gas is more pronounced. Should these hard feces enter the sacculation, it is difficult for these bottleneck protrusions to empty themselves since they have no muscular coat and the neck is smaller than the sac itself. Thus, the hard feces left in these sacculations continue to dehydrate, are subjected to bacterial action and may go on to form fecaliths. These in turn may be the source of irritation, and if inflammation of the

sac wall results, we have the characteristic syndrome called diverticulitis. If the inflammation will assume a chronic nature, but clinical evidence shows that diverticulitis is by far rarer than disease of the gallbladder or appendix." Willard

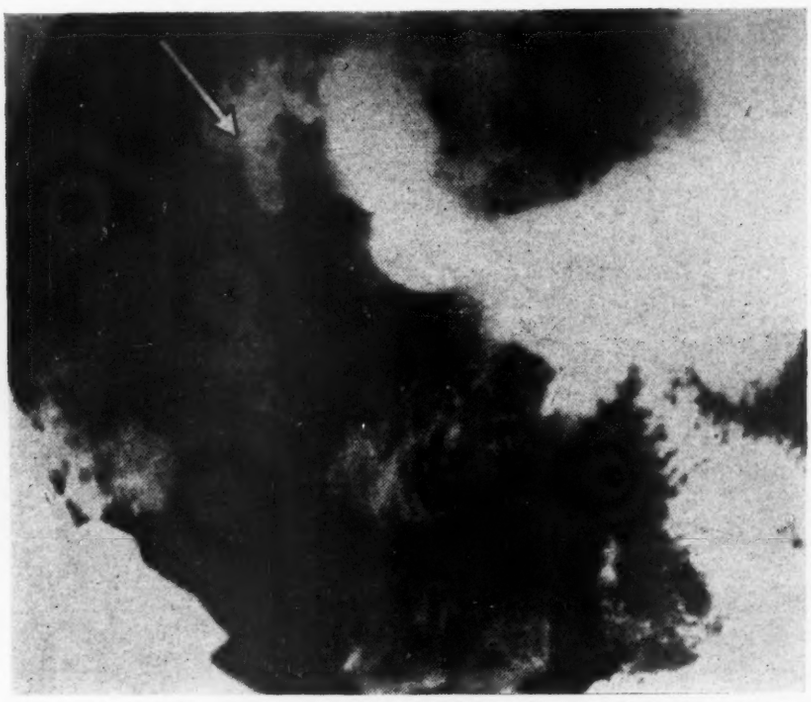

FIG. 5. Diverticulum of duodenum. (From ABELL, IRVING. Diagnosis and treatment of diverticulitis and diverticulosis. *Surg., Gynec. & Obst.*, 60; 370–378, 1935.)

the inflammatory process may extend to the adjacent structure causing peridiverticulitis. This process may involve one or more sacs. This inflammatory process may go on to resolution, may progress to perforation with resultant diffuse suppurative peritonitis, or may go on to abscess formation and may perforate into adjacent structures, vesical bladder, intestines, etc.

Bleeding from the bowel caused by diverticula is reported to have occurred in older individuals. Ochsner and Bargen noted bleeding in 5 per cent of their patients; other investigators have not met with a similar experience. Erdmann has made a very courageous statement: "The presence of diverticula in the intestines merits no greater attention than does the existence of the appendix or gallbladder except that there may be many diverticula, while there is only one appendix and one gallbladder: therefore, ordinarily the chance of acute diverticulitis would be greater, and Bockus are of a different opinion: "Diverticulosis should not be considered a rare abnormality, because, while diverticula appear to be harmless at the moment, they might have been or will be the seat of inflammation." Such a position is shared by most recent observers. It follows then, that while the physician should not make the patient conscious of the abnormality existing in his alimentary tract, the patient should be warned to eliminate from his diet foodstuffs that favor constipation, such as bran, whole wheat, popcorn, nuts, berries with large seeds, etc. The patient should be encouraged in the use of drugs that favor elimination because the presence of diverticula in the colon constitutes a potential focus of acute or chronic infection and such a condition merits attention. The presence of these pouches in the colon is a direct evidence of weakened intestinal wall. Diverticulosis is usually associated with periods of diarrhea or

periods of constipation and efforts should be directed toward the removal of those forces which have the tendency to increase intracolonic pressure. Constipation, therefore, must be reduced as much as possible.

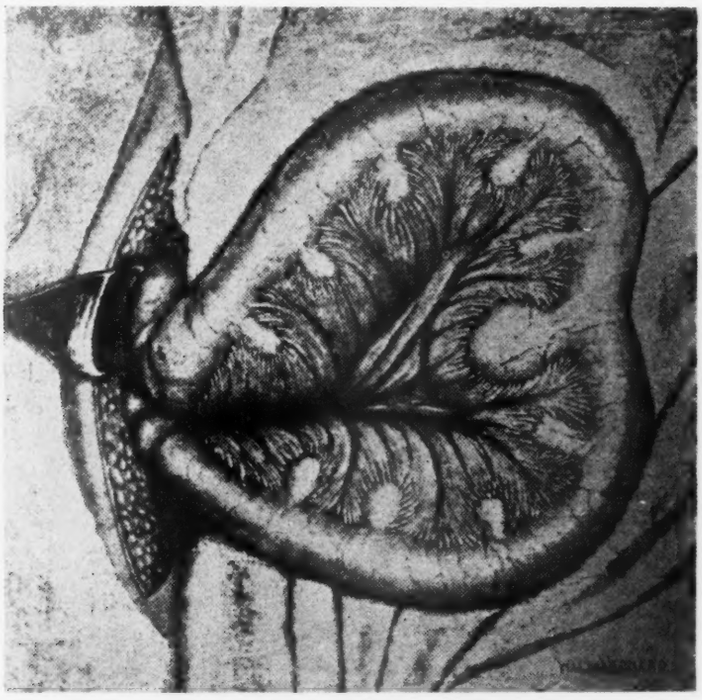

Fig. 6. Diverticula of jejunum with fecalith producing partial obstruction. C. M. Watson. (From Abell, Irving. Diagnosis and treatment of diverticulitis and diverticulosis. *Surg., Gynec. & Obst.*, 60: 370–378, 1935.)

In case of resection of the colon in the presence of diverticulitis microscopic examinations should always be made to ascertain the presence of cancer cells. Diverticulitis may be only a coincident factor or both conditions may be present. These abnormalities may give rise, as mentioned above, to severe symptoms demanding appropriate therapy. An infected diverticulum of the cecum or ascending colon may simulate appendicitis and the differential diagnosis cannot be made until the peritoneum is opened. A chronic inflammatory process of the diverticulum may result in great thickening of the wall of the gut causing a partial obstruction of the colon, a condition which is frequently mistaken for carcinoma.

Diagnosis. Diverticulosis causes no symptoms. Diverticula are frequently discovered in a routine *x*-ray examination. This is the only method by which they may be definitely diagnosed. The barium, either meal or enema, used for this purpose may remain in the sacs for a long time, perhaps weeks and even months without producing any untoward effects. Sigmoidoscopic examination may be of value. If the diverticula are lower down, the openings can be seen through the scope. Usually the pouches are higher up and can best be visualized after the barium has been expelled. The sacs will retain some of the shadow-casting media. D. F. Jones states that 12 to 15 per cent of patients with diverticulosis will develop diverticulitis.

When a patient presents himself with the history of left lower abdominal pain or discomfort with flatulence and irregularity of the bowel, diverticulitis should be kept in mind. In females due consideration must be given to structures present in the left pelvic floor. In making the diagnosis of diverticulitis, the age and the aspect of the patient must be considered.

The majority are in the fourth or fifth decade, are short, stocky and overweight. They usually give a history of some dietary indiscretion. The onset is characterized by pain in the lower left quadrant associated with nausea or vomiting, rising of temperature and pulse rate followed by tenderness, rebound tenderness and rigidity of the abdomen, usually extending from the left iliac fossa to the mid-hypogastric region. The blood examination presents the usual picture of an acute infection with leukocytosis.

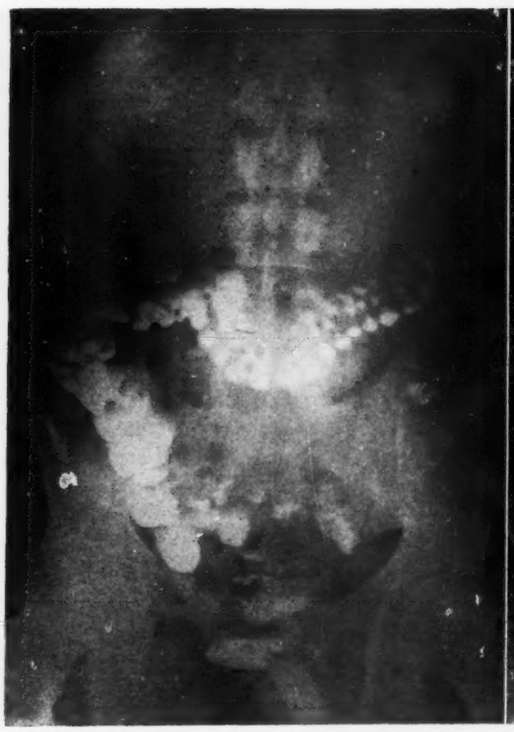

Fig. 7. Reproduction of *x*-ray of patient taken in October, 1940.

Fig. 8. Reproduction from original *x*-ray taken of patient in February, 1944.

Treatment. Diverticula of the colon are considered here. A patient with diverticulosis should be under the care of a physician. Foci of infection which have a tendency to lower body resistance should be eliminated. The patient should pay considerable attention to keep in good health; he should have regular habits, indulge in moderate exercises, discourage overweight and avoid heavy lifting or anything that may increase intracolonic pressure. He should have a simple diet and avoid constipating food. Since the condition has a tendency to progress, it is suggested that the colon be *x*-rayed once or twice a year. The administration of mineral oil and agar-agar in liberal doses will help elimination, although some investigators do not place much credence in the efficacy of these drugs. An enema may be given at frequent intervals. Some investigators have given barium or bismuth by mouth at stated intervals. The principle behind this therapy is to allow these drugs to deposit in the sacculations and thus prevent fecal material from entering them. This treatment has not met the favor of most clinics. Most observers divide the treatment for diverticulitis into medical and surgical. A patient with diverticulitis should be kept in bed at least three weeks. Nothing should be given by mouth for the first forty-eight hours. The inflamed colon should be put at rest. The regular amount of water in 5 per cent glucose with saline, at least three quarts per day, should be given parenterally. The application of

heat has been found beneficial. The use of hot fomentation and the electric pad may be applied over the suspected area. This process facilitates the cleansing of the bowel; and if the water reaches the affected sacculation, it may help to dis-

Fig. 9. Frontal view of patient as he looks today.

Fig. 10. Side view of patient as he looks today.

Short wave diathermy used several times a day has proved very efficient. The Elliot treatment is of some value for women but less satisfactory for men. The bag introduced into the vagina with a return flow of hot water seems to be tolerated well by the patient but it is not supported well by males when applied through the rectum. When the tenderness has localized, an ice bag can be applied over the area. Small warm enemas of salt solution can be used. solve the contents. Retention enemas of warm olive oil given in the knee-chest position are comforting and promote bowel movements. During the attacks some surgeons suggest the use of belladonna and its derivatives. I have had good results with bellafolline. Others believe that these drugs have no therapeutic value in an inflamed diverticulum. If the acute attack subsides, the patient may be treated as a case of diverticulosis.

John Erdmann is of the opinion that as soon as the diagnosis of diverticulitis is made, all patients with acute conditions must be operated upon. He further states, "that there is no more reason to wait or try medical treatment than there is in an acute appendicitis or an acute tubal infection." Such a radical position is not shared by all surgeons. Judicious medical treatment has at times warded off an operation. A victim of diverticulosis may have many attacks before the end comes and if each attack is treated surgically, the patient might go through many an operation.

However, if the symptoms of acute inflammation do not subside with conservative treatment, surgical intervention is deemed necessary. A progressive inflammatory process can be summarized thus: increased pain, rise of temperature and pulse, increased leukocytosis with the general condition of the patient becoming worse.

William R. Jones has divided diverticulitis that requires an operation into five groups: (1) acute conditions which do not subside when treated medically; (2) acute perforation; (3) abscess formation; (4) chronic inflammatory conditions with fistula or obstruction and (5) malignancy.

It is not the scope of this paper to cover all the detailed procedures of each problem. That is left to the orientation of the surgeon.

Prognosis. In cases of diverticulosis, in a large percentage of cases, diverticula produce few or no symptoms and, as stated before, are accidentally found. Many investigators believe that diverticulitis (and peridiverticulitis) develops in 12 to 17 per cent of patients. The subject is still under consideration and it may change with more accurate study of all the cases in the various clinics. The results for the surgical treatment of diverticulitis depend on the age, condition of the patient at the time of the attack and the area involved. Daniel Jones stated that operations for diverticulitis carry a mortality from 12 to 22 per cent. An acute condition of the appendix can easily be removed, whereas the surgical procedure for diverticulitis involves greater risk. Cases of fistula and abscess are serious and require careful surgical judgment. Perforation with diffuse peritonitis carry a very high mortality.

CASE REPORT

M. P., twenty-six years old, a white male, junk dealer by trade, was well developed and well nourished. During infancy he had had measles, pertussis and parotitis. He stated that as far back as he could remember the bowel function was never regular. To his recollection his life was associated with abdominal cramps, which annoyed him a great deal periodically. They were so frequent, that whenever he could hide the evidence of these cramps from his mother he would go through that torture gladly to spare himself the enemas which his mother would automatically submit him to. His chief complaints have been (1) flatulence, (2) constipation, associated from time to time with attacks of diarrhea and (3) repeated attacks of crampy-like pains beginning around the umbilicus and extending over the entire left quadrant. His childhood life had been associated with many episodes of constipation, frequent diarrhea and abdominal cramps.

His mother was of the opinion that these attacks of abdominal distress were caused by an improper ingestion of food. She was told that the condition was some form of "enteritis" and since the boy was attending school and no close watch could be kept over his food, she became resigned to the fact that perhaps as the boy would grow the condition might improve. She had become so accustomed to these abdominal symptoms that whenever he would have an attack she would administer a mild laxative (milk of magnesia) or she would give the boy a simple enema. She would put the boy to bed for a day or two, place him on a light diet, mostly fluids, and would give him a soap suds enema. This treatment was continued until the attack subsided.

In the winter of 1934 the boy had a severe and prolonged attack of crampy abdominal pains. These symptoms were too severe and being associated for the first time with nausea

and vomiting, the mother became alarmed and took the boy to my office.

The abdominal examination revealed many points of tenderness around the umbilicus, more marked in the left middle quadrant. The abdomen was soft. No masses could be palpated. No fever was present. The pulse was normal. This episode of abdominal distress was preceded by many watery movements. I ordered the patient to bed for several days. Hot fomentations were applied to the abdomen and the boy was placed on a liquid diet. Small low saline enemas were given every four hours for the first twenty-four hours. As soon as the pain was under control, the enemas and the fomentations were discontinued. At no time during the following days was there any rise in temperature or a rise in pulse rate. The clinical picture remained constant. These vague symptoms, associated with a history of recurrence for many years, led me to suspect the existence of extensive disease somewhere in the alimentary tract.

Several weeks later, when the acute attack had subsided, the gastric series were done with a barium meal and to my surprise I found that the transverse and splenic flexure of the colon was studded with many diverticula. This new evidence finally solved a problem which had been unknown for all the preceding years. What was thought to be a plain case of enteritis, now became clear as a case of diverticulosis. As one, two or many of these diverticula became engorged with material, the pressure caused by this material within these sacs gave the patient all the symptomatology enumerated.

During these past twelve years the patient has been under my observation. He has been instructed to avoid food stuffs that leave a high residue or substances that favor constipation and also to keep his bowels open with mild laxatives. The patient has observed that whenever he would violate these instructions, the abdominal distress would recur. He has also noticed that the use of peanuts in his food would surely precipitate an attack a day or two later.

For the past two years he has scrupulously observed these rules and has faithfully used mineral oil every night. Under this regimen two years have elapsed without any attacks. A question comes to my mind as to whether the presence of these diverticula is responsible for the marked irritability that the boy experiences whenever he is under tension. The nervous system is so stimulated that he actually suffers trembling fits, is easily frightened, his speech becomes incoherent, etc., so much so that in passing the military examination he was placed in 4F for this condition. How much does the autonomic nervous system play with such extensive disturbance in the alimentary canal? If one recalls the embryo-anatomical course of the vagus with its function and the influence that the vagus plays on the abdominal viscera through the interaction with the abdominal plexuses, one can understand the phenomenon.

CONCLUSIONS

1. Diverticulosis and diverticulitis have been properly recognized and treated during recent years.

2. Vague abdominal complaints associated with flatulence, constipation and diarrhea deserve an *x*-ray examination of the alimentary tract to determine the presence of diverticulosis.

3. Experiments both on human cadavers and on living dogs have not added much information as to causation. Notwithstanding the fact that many prominent surgeons are of the opinion that diverticula are caused by a congenital defect in the anatomical structure of the alimentary canal, in the absence of more definite conclusive evidence, the theory of causation is still under discussion.

4. Diverticulosis occurs in about 5 per cent of the cases investigated for disease of the colon. Approximately from 12 to 15 per cent of persons with diverticulosis will develop diverticulitis.

5. Treatment of diverticulosis and mild diverticulitis is medical and that of severe diverticulitis is surgical.

6. Plastic procedures for the relief of diverticulitis should be preceded by a colostomy or by a cecostomy. The sulfa drugs will play a big rôle in the treatment of these conditions.

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Intestinal obstruction may occur from herniation of bowel through the opening in the transverse mesocolon into the lesser peritoneal cavity. Nearly all of the small intestines may enter the lesser peritoneal cavity, protrude through the gastrocolic omentum, and hang in front of the transverse colon. This, as well as secondary adhesions, should be relieved by reoperation.

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea & Febiger).

SOLITARY EOSINOPHILIC GRANULOMA OF BONE*

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SOLITARY eosinophilic granuloma, according to the literature, is a very rare lesion. As late as July, 1943, only twenty-one cases had been reported although many others may have been recognized and not reported. Of these, fifteen were solitary lesions and only three of them were located in the long bones. Six other cases were described by Green and Farber with multiple lesions involving both long and flat bones, possibly presenting a different clinical entity. We are describing two new cases involving long bones.

From our experience it is likely that the significance of this lesion has been unrecognized in the past. At least, it is being recognized more commonly in the past few years.

Review of the literature is unnecessary here as it has been done recently by Jaffe and Lichtenstein[11] and Kernwein and Queen.[12]

CASE REPORTS

CASE 1. A. M., a male, age fifteen, No. 492484, was admitted on July 13, 1942, complaining of pain in and about his left clavicle. Early in June, 1942, he had fallen on the right shoulder, but the left one hurt. He was admitted to a hospital on June 16, 1942. After *x*-ray study, a malignant tumor was suspected and an aspiration biopsy attempted. Insufficient tissue was obtained. He was discharged after a week. His pain and noticeable swelling about the clavicle persisted until his admission to the Mt. Sinai Hospital three weeks later or about six weeks from the date of onset.

Physical examination was negative except locally where there was a firm, tender, mass about the size of a hen's egg in or attached to the left clavicle in its outer third. There was marked local tenderness. The skin was not adherent over it. A small supraclavicular nodule was felt on the left side but the boy had been aware of this for a long time.

Laboratory studies revealed the following: Temperature, pulse and respiration were normal. Sedimentation time was two hours seven minutes (Linzenmeier); blood hemoglobin was 91 per cent, white blood cells 8,900 per cu. mm. with a normal differential; eosinophiles were 1 per cent; urine and blood Wassermann tests were negative; blood calcium was 10.5 mg. per cent, phosphatase 17 King-Armstrong units per cent. Blood cholesterol was 290.

X-ray studies on July 14th (Fig. 1) showed an irregular expansion of the shaft of the lateral third of the clavicle. Bony trabeculae extended throughout a bony defect in the expanded area. The lesion was about 5 cm. long. At several points, the cortex had been completely eroded. There was a moderate amount of periosteal new bone formation extending mesially from the bony lesion along the shaft of the clavicle. Tentative diagnosis of a primary bone tumor was made with the most likely possibilities giant cell tumor, chondroma or chondrosarcoma. The chest and long bones were negative for any other lesion.

An open operation was decided upon with frozen section for diagnosis at the operating table. A small incision was made over the mass and a biopsy specimen removed. Frozen section without hematoxylin-eosin stain was inconclusive. In view of the possibility of malignancy, resection was decided upon. The outer half of the clavicle containing the lesion was removed *en masse*. (Fig. 2.) The "tumor" tissue had eroded through the cortex of the clavicle dorsally and, especially, inferiorly in the region of the coracoid process. Some of this tissue was attached to the soft tissue overlying the coracoid and was grossly removed thence. The supraclavicular nodule previously felt was also removed.

* From the Orthopedic Service of the Mt. Sinai Hospital, New York, service of Dr. Robert K. Lippmann.

The wound healed by primary union and rapid functional recovery occurred. Eleven days postoperatively there was no deformity, no dysfunction of the left shoulder or arm, and no restriction of motion whatever. The pathologic report, dated July 23, 1942, by Dr. S. Otani, was solitary eosinophilic granuloma of the clavicle, and lymph node showing no significant changes except infiltration of eosinophilic leukocytes. (Fig. 3.)

Fig. 1. Case 1. The destructive lesion of clavicle. Note expansion of the bone, erosion through cortex, pathologic infraction, periosteal new bone formation suggestive of malignant neoplasm.

After this report had been received, a course of *x*-ray therapy was given. This was in mild dosage, not as for malignant tumor. Excellent function has persisted without any disability or sign of recurrence to date. This is despite the fact that some bone regeneration occurred at the medial portion of the site of the resected clavicle. (Fig. 4.)

Case II. R. D., a male, age two and one-half years, No. 504420, was in the hospital from April 21, 1943, to June 3, 1943, and again from June 11, 1943, to August 12, 1943. Four weeks before admission, this child began to awaken at night and cry with pain holding his left lower limb rigid. There was some limp when up and around, but no known fever or malaise. The pain and limp became progressively worse until three days before admission when his parents noted a local swelling on the left leg anteriorly which was very sensitive to touch. His temperature was then found to be 101°F. but this had subsided by the time of admission.

Physical examination was negative except for the local findings in the upper left leg. There was increased local heat, swelling, and infiltration of the soft tissues over the upper end of the left tibia. Marked tenderness, and a mild limp were present.

Laboratory studies revealed the following: Temperature, pulse and respiration were normal. Blood sedimentation rate was 48 minutes. Hemoglobin on admission was 72 per cent, and the white blood count was 8,000 with 3 per cent eosinophiles. A count two months later, on June 15th showed no significant change. Blood Wassermann and tuberculin patch tests were negative; urine examination was normal. Culture of the bone cavity at operation, both aerobic and anaerobic, was

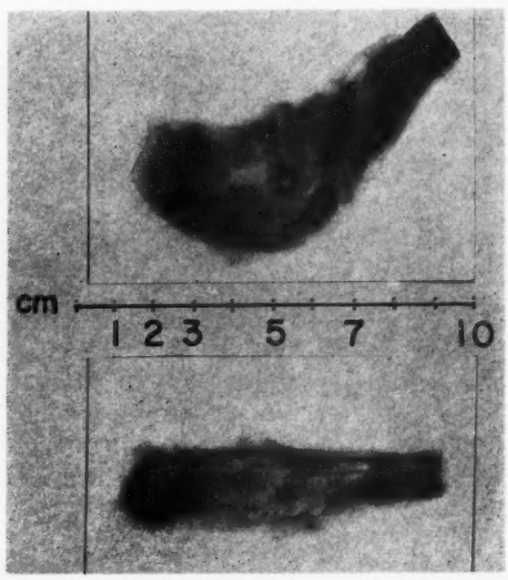


Fig. 2. Case II. *X*-ray of specimen removed at operation, outer half of clavicle including the lesion.

negative, although later culture of the sinus which developed postoperatively showed Staphylococcus aureus A. A sternal bone marrow puncture on May 21st showed no increase in eosinophiles.

X-ray findings (Fig. 5) in the left leg showed a destructive lesion involving the proximal third of the shaft of the left tibia. The lesion had eroded the anterior cortex and invaded the medullary cavity as far as the endosteal zone of the posterior cortex. It had also extended laterally in either direction. It had produced a periosteal reaction mostly on its medial but also in its anterolateral aspect. The destructive zone extended almost to the epiphyseal line in the diaphysis and was eccentrically placed. The original tibia outline showed no expansion. Diagnostic ventures were (1) Ewing's tumor; (2) osteomyelitis.

Study of the long bones on April 24th, and the skull and ribs on April 30th showed no abnormality.

Operation was performed on April 24, 1943. Biopsy was done through a vertical skin incision over the lesion. A window was made in the cortex about 2.5 by 1.25 cm. A cavity

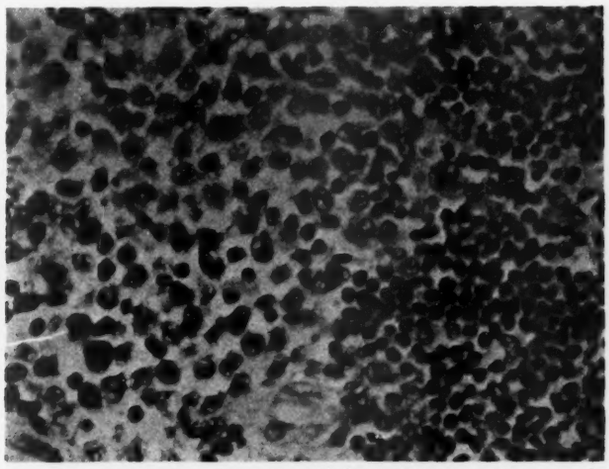


FIG. 3. Case 1. Note in the one field collections of large pale histiocytes, and in the other the darker clumps of eosinophils. These are bright red in the original slide stained with hematoxylin-eosin. × 525.

FIG. 4. Case 1. October 13, 1942, three months after operative resection, showing bone regeneration, but no evidence of the original lesion.

containing reddish gray soft material was entered. This was completely curetted and found to extend very close to the epiphyseal line. Although the tissue resembled low grade infection, suggesting osteomyelitis, the wound was closed completely after introduction of sulfathiazole. Culture was taken of the bone cavity, anaerobic and aerobic. No cast was applied.

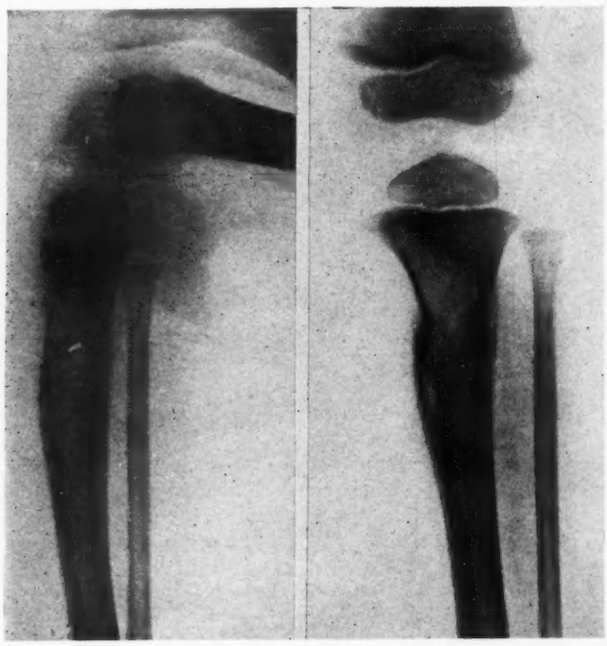
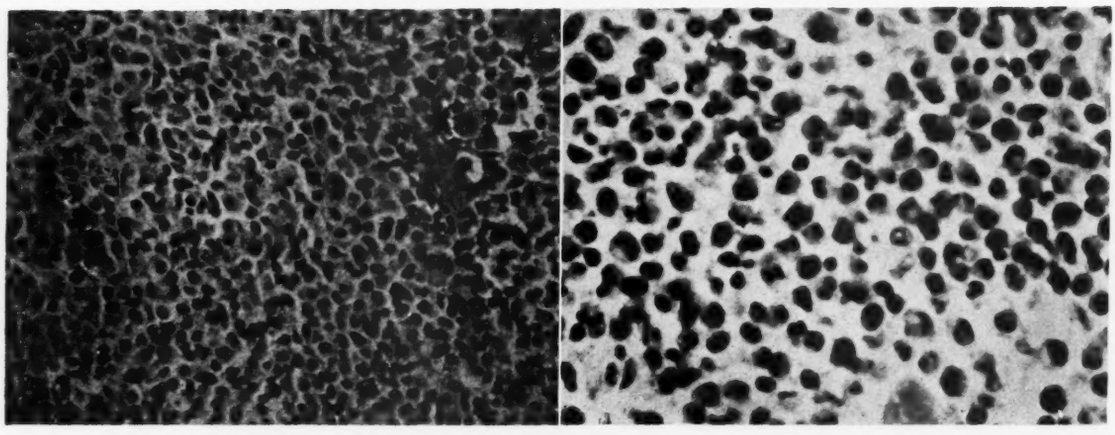


Fig. 5. Case II. Notice cystic, destructive lesion of upper end of tibia with periosteal new bone formation, without expansion of the cortex, suggesting osteomyelitis or Ewing's tumor.



A B

Fig. 6. Case II. A, showing mainly the histiocytes with scattering of eosinophilic leukocytes, and a few giant cells. × 325. B, higher power showing more eosinophils, but many histiocytes and rare giant cells. × 850.

The pathologic report on the curettings, made by Dr. Otani on April 28th, was solitary eosinophilic granuloma. (Fig. 6A and B.)

Healing was complicated by formation of a sinus from the upper angle of the wound after a hematoma had collected. This became frankly infected after a few days, culture showing Staphylococcus aureus A. He then developed intercurrent measles after exposure despite administration of pooled plasma and was discharged. He was readmitted June 11th for further treatment.

X-ray of the left leg at this time (Fig. 7) showed some bone regeneration but also an expansion of the bone at the original site of the

lesion which might have been due to periosteal new bone formation as reaction to operation. Roentgen therapy was then begun on July 1st, twelve treatments being given, of 75 r every three to four days.

Fig. 7. Case 11. Two months later, after curettage. Note expansion of metaphysis, probably by periosteal proliferation with continued erosion from within.

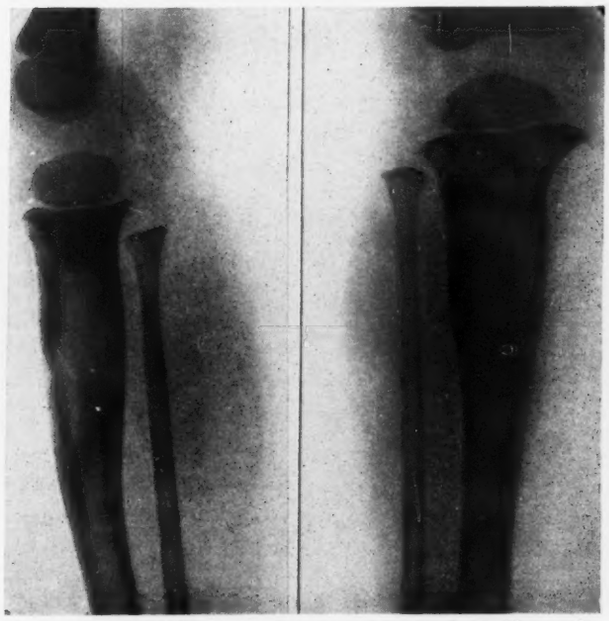


Fig. 8. Case 11. After radiotherapy, three and a half months post-curettage. Note healing appearance of lesion with cortical regeneration.

The sinus promptly healed and bone regeneration ensued. By the time of discharge, *x*-ray examination (Fig. 8) showed considerable regeneration of bone and reconstitution of the outline of the tibia with a general healing appearance of the lesion. He was sent to a convalescent home where he remained a month. Ever since he has been clinically well. The wound has remained well healed and the swelling has entirely disappeared. The mother states that at times he complains of some

vague pain in this leg. Tenderness and local reaction were entirely absent on his last clinical examination in April, 1944. Final *x*-ray study, not always, of short duration. The lesion usually occurs in children and young adults. It can occur in older people as shown by a

FIG. 9. Case 11. After radiotherapy one year post-currettage. Note excellent healing of bone.

(Fig. 9) shows practically complete healing of the lesion with bone regeneration.

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

Eosinophilic granuloma is often a solitary lesion, although cases exhibiting simultaneous multiple lesions with the same pathologic picture have been reported. In these, the skull and ribs have chiefly been involved. The clinical picture is that of bone pain, generally, though case in a man over fifty.[16] This might be expected in view of the destructive nature of the lesion. Our cases, and most of the ones in the literature involving long bones have been located near the ends of the bones, just as in many bone neoplasms and osteomyelitis. Trauma played a dubious part in one case, although reported in others in the literature. On examination, it is not possible clinically to determine whether the lesion is neoplastic or inflammatory as it partakes of the characteristics

of both in the various cases. Locally in our two cases, there was increased heat, soft tissue infiltration over the bone, local swelling and exquisite tenderness. Dysfunction of the limb or neighboring joints was due to the bone pain.

Laboratory findings are entirely unrevealing except for the *x*-ray examination of the local lesion. Temperature, pulse, sedimentation rate, blood calcium, phosphatase, cholesterol, white blood count, and differential as well as urinalysis are normal. No general eosinophilia has been found either in the blood count or in a single sternal bone marrow aspiration. *X*-ray examination of other long bones, chest, and skull in these cases has been negative for other lesions.

X-ray examination shows a primarily destructive lesion which has eroded the cortex of the bone, and even broken through the cortex in one or more places. At the same time, the bone may or may not be expanded at the site of the lesion. The cortex is preserved for the most part. Expansion of the shaft may be secondary to periosteal reaction as a result of fracture, operative trauma, or extension of the lesion through the cortex spontaneously. No bone sclerosis or formation occurs in the lesions themselves which appear rapidly progressive and destructive.

The diagnosis in each case was made only on pathologic study of excised material either at biopsy or after resection of the lesion. This emphasizes again the inadequacy of all clinical methods short of pathological examination in the diagnosis of doubtful or obscure bone lesions. Even pathological study may be inconclusive if not complete on adequate material, as is shown in our Case 1, in which a frozen section at the operating table showed a questionably "malignant" lesion while eosin stain later in the laboratory revealed the true nature of the condition. Diagnosis based on the *x*-ray films alone is misleading although we believe that future cases may be suspected before biopsy if the lesion is borne in mind.

In the case of solitary lesions, differential diagnosis must be made from primary bone tumors such as benign giant cell tumor, chondroma and chondrosarcoma, Ewing's tumor, osteolytic osteogenic sarcoma, bone cysts, and the various types of specific (luetic, tuberculous) and non-specific osteomyelitis. No detailed differential is required here as none of the findings is conclusive except through pathological study of excised material. Multiple lesions may be confused with generalized rare destructive bone diseases such as xanthomatosis, Hodgkin's disease, and metastases from neuroblastoma.

PATHOLOGY

The pathology has been amply described in detail by Otani, Jaffe, Farber, and others. The essential features consist of destruction of spongy and cortical bone by granulomatous tissue. This tissue is composed of two types of cells for the greater part. One type consists of large, pale staining mononuclear cells which are typical histiocytes. These may have mitotic figures which are never anaplastic. The other chief cells are the eosinophilic leukocytes. These may be so numerous as to color the microscopic field bright red with hematoxylin eosin stain, giving a characteristic appearance. Different fields may vary in the relative preponderance of these types. There is very little supporting stroma and little or no bone is left in the center of the lesion. Hemorrhage and necrosis occur occasionally. If pathological fracture has occurred, an ingrowth of fibrous tissue resembling callus has been noted as well as periosteal proliferation. Occasional giant cells of the osteoclastic type are present, but these are not characteristic. In neither of these cases, nor in any of the cases seen by Dr. Otani, have foam cells been found although sought for.

PATHOGENESIS

This is a relatively new clinicopathologic entity and as such has not been definitely classified. The etiology is, of course, un-

known. General opinion tends toward inflammatory rather than neoplastic origin, although no causative organism has been detected. The cases of multiple lesion have been likened and confused with xanthomatosis (Hand-Schuller Christian's syndrome), and non-lipoid reticulo-endotheliosis (Letterer-Siwe's disease). Indeed, the most recent publications[10,11,20] have emphasized this relationship. Green and Farber in reporting thirteen cases, have concluded that this lesion does not constitute a new disease, but represents one variant of a basic disease process, including Hand-Schuller Christian disease, certain forms of xanthomatosis and Letterer-Siwe disease. Gross and Jacox, in a report of three cases of multiple destructive lesions of bone, two of which are cases of xanthomatosis and one Letterer-Siwe disease, would seem to add further support to the theory that eosinophilic granuloma and xanthomatosis are variants of a basic disease process. Otani and Ehrlich, on the other hand, in discussing their report of four cases of solitary eosinophilic granuloma, regard this newly discovered lesion as a separate clinicopathologic entity, not to be confused with xanthomatosis.

The supposed similarity has been based chiefly upon the presence of many histiocytes in each of these lesions and the occasional appearance of many eosinophiles in all of them. Jaffe and others most recently have attempted to classify them as stages or phases of an identical underlying process presumably an obscure type of infection. The eosinophilic granuloma, although mild in nature, is supposedly the most acute phase. Letterer-Siwe's disease represents a disappearance of the eosinophils with emphasis on the histiocytes. Schuller-Christian disease would then be the most chronic phase with lipoid deposition in the histiocytes.

There are many difficulties inherent in such a classification. While in between and borderline cases of each of these conditions have been reported, we wish to emphasize that the clinical picture of our cases of eosinophilic granuloma has in no way resembled the course of the other much more serious, indeed, fatal conditions. Regardless of the similarity of the histology of some of these cases, the clinical course is entirely distinct.

Xanthomatosis and non-lipoid reticulo-endothelioses are characterized by marked multiplicity of the lesions, involvement of the viscera, anemia, fever, and progressive downhill course in a variable period of time resulting fatally. Xanthomatosis, both general and local contain foam cells by the usual definition, and without these a definite diagnosis cannot be made. Eosinophilic granuloma on the other hand, is always benign, responds well to treatment, is not progressive, does not involve the viscera, and does not make the patient ill except for the local bone pain. No lipoid containing cells are found resembling foam cells.

We, therefore, believe that for the present, until further knowledge accumulates, these conditions should be regarded as separate clinicopathologic entities, rather than phases of the same general underlying disorder.

PROGNOSIS AND TREATMENT

Recognition of the lesion and its benign nature is very important in the management of the case. All the cases in the literature, with the exception of a few of the multiple ones which may have been cases of xanthomatosis, or non-lipoid reticulo-endotheliosis, recovered after curettage or resection either with or without subsequent radiotherapy. In a few of the multiple cases, some of the lesions disappeared spontaneously or after a small amount of radiotherapy. Our cases have been similarly favorable in outcome. Both patients are alive and well thus far with no sign of extension or recurrence.

All measures have been effective. Resection would seem satisfactory when the lesion is located in a bone which can be sacrificed with little or no functional impairment. This was satisfactory in one

of our cases even though some of the cellular tissue had to be left behind. The rôle of radiotherapy is more difficult to evaluate. In our Case II, it is likely that it was important in controlling the lesion since the involved area appeared to expand and grow larger after curettage and sinus formation. It subsided gradually, with sclerosis and reconstitution of bone and healing of the sinus after twelve low-dose treatments such as are given for infectious and granulomatous lesions generally.

SUMMARY AND CONCLUSIONS

1. Two new cases of solitary eosinophilic granuloma of long bones are presented.

2. This is a well defined clinical and pathologic entity to be distinguished from similar multiple lesions which may represent variants of xanthomatosis or non-lipoid reticulo-endotheliosis

3. Biopsy and careful pathologic study are necessary for the diagnosis. The pathologic characteristics of the lesion are given and its distinction from xanthomatosis.

4. Treatment consists of surgery, and/or radiotherapy in small doses as for inflammatory lesions. Surgery may be curettage or resection where practical without loss of function.

5. The patients are well at the present time. The lesions in these and the other cases in the literature have all proven to be benign, without recurrence, at least thus far.

6. The solitary eosinophilic granuloma may turn out to be one of the more common of the destructive bone lesions in children and young adults and should be borne in mind in such cases.

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HEMANGIOMA OF THE INTESTINE*

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HEMANGIOMA of the intestinal tract is rare and is frequently overlooked in differential diagnosis. In most cases surgery at the proper time will effect a cure while the mortality in those untreated is extremely high. An additional and characteristic case seems worth reporting.

CASE REPORT

F. J. D., Denver Children's Hospital No. 42-8703, a girl aged sixteen years, was admitted March 7, 1942, because of a marked anemia. The provisional diagnosis was anemia, etiology unknown.

Her family history was negative with no known bleeding tendency. In her past history, children's diseases were noted, she was subject to winter colds, the tonsils and adenoids had been removed at seven years without incident and she had had bronchopneumonia two years before.

She had always been pale as long as she can remember. More severe pallor came in attacks usually following some infection or gastrointestinal upset. These attacks were associated with nausea and vomiting, cramps, pain in the back and marked weakness. They occurred several times yearly. She was told that after these attacks her hemoglobin became as low as 40 per cent. After each attack she took liver and iron medicine and gradually improved. There was never noted any blood by bowel but at times the stools were quite black which appearance was ascribed to the iron. She has had a food craving, often eating paper, usually the unprinted part of magazines. Menstruation started a year before entrance and had been regular and scant.

Physical examination was essentially negative except for her skin which was pale and wax-like. The mucous membranes were also quite pale. Over the heart was heard a systolic murmur most pronounced at the base. The abdomen was negative except that the spleen could be felt on deep inspiration.

On admission the hemoglobin was 22 per cent, red blood count 1,120,000, white blood count 6,400 with 79 per cent polymorphonuclears and 18 per cent lymphocytes; there were no abnormal cells. Reticulocytes made up 1.6 per cent of the reds. The stools were strongly positive for blood by the guaiac and benzidene test on a meat-free diet. The total protein was slightly low, 4.8. All other laboratory tests including an icteric index, red cell fragility, sternal puncture, gastric analysis and blood Wassermann were negative. A gastrointestinal *x*-ray series was normal, the jejunum and ileum being checked three times. Sigmoidoscopic examination was negative.

The child received frequent transfusions, a total of six preoperatively but the highest blood level was only 44 per cent with 2,880,000 red blood corpuscles. This was on March 31, 1942. However, on April 8, 1942, the child had rather severe abdominal pain, food craving appeared—she desired olives and paper—and the stools appeared quite dark but not tarry. Following transfusion a laparotomy was done on April 11, 1942.

A right rectus retracting incision revealed immediately a purplish tumor covering roughly 5 inches of the ileum over its whole circumference about 14 inches above the cecum. There were no adhesions. The blood supply did not seem to be excessive. The appearance was that of a mass of deep purple varicose veins. No other abnormality in the intestine was noted. There was a long normal appearing appendix and no Meckel's diverticulum. Six inches of the small intestine were resected, the ends closed and a lateral anastomosis performed with an inner layer of continuous fine catgut and an outer of interrupted silk. (Figs. 1 and 2.)

The postoperative course was entirely uneventful. The blood remained up without transfusion, the stools were negative for blood and the blood count at the time of discharge on

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April 26, 1942, was 78 per cent hemoglobin, 4,200,000 red corpuscles, 5,500 white corpuscles.

The specimen removed was reported by Dr. William C. Black as follows:

Gross description: Specimen consists of a segment of small intestine (ileum), 14 cm. in length, 5 cm. in width. There is a large roughly oval, purplish-red mass measuring 8 by 4 by 1.5 cm. lying in the wall of the intestine along its free margin. The mass nearly reaches the mesenteric border on each side. It is smoothly covered with peritoneum and consists of a great number of thin-walled blood vessels distended with liquid blood. When incised the tumor oozes blood freely. The lumen of the intestine is filled with liquid blood. The mucosa is directly underlaid by the tumor with resulting purplish discoloration and many uneven semi-polypoid elevations. Petechial hemorrhages are scattered through this portion of the mucosa. No large bleeding points are demonstrable. The intestinal wall, including the mucosa, above and below the tumor appears entirely normal.

Microscopic Description: The wall of the small intestine contains many endothelial-lined passages which branch and anastomose within the muscle layers and submucosa. Some of these contain blood while others are empty. The serosa forms the only outer covering for these vascular channels, and they are seen to reach into the mucosal stroma internally. There is no endothelial cell proliferation evident. A few of the vascular walls and channels are filled with amorphous calcium salt deposits.

Diagnosis: Cavernous hemangioma of small intestine. (Figs. 3, 4, 5, 6, 7 and 8.)

Not many cases of hemangioma of the intestine have been reported. Small angiomas on the body surface are common and may grow rapidly after birth but these tumors are much less common inside the body cavities. Geschickter and Keasbey[1] who reviewed 570 cases of hemangioma at the Johns Hopkins Hospital found only ten involving the internal viscera including the mesentery, kidney and gastrointestinal tract.

Cases appear in the surgical literature from time to time, most of which represent the single experience of the author. In 1922, Judd and Rankin[2] reported four cases from the Mayo Clinic, three hemangiomas of the stomach and one of the duodenum. The outstanding symptom was hemorrhage. The different types of intestinal hemangioma were described by Brown[3] in 1924 after he had operated on a patient with acute obstruction due to an encircling hemangioma of the jejunum. He was able to find at that time nineteen other cases. He divided them into four groups ranging from capillary nevus up to encircling cavernous hemangioma. McClure and Ellis[4] collected twenty-four cases of which eighteen had symptoms and they reported one of their own. Exploratory laparotomy on their patient showed multiple hemangiomas of the liver and spleen as well as of the whole intestinal tract which prevented any removal. The patient died four months later from hemorrhage.

The most complete recent coverage of this subject is that of Kaijser.[5] He collected seventy-four cases from the literature and reported two of his own. One patient, a girl of nineteen, had an irremovable cavernous hemangioma of the stomach and esophagus; the other, a boy of eight with a hemoglobin of 20 per cent recovered after resection of the sigmoid for an infiltrating cavernous hemangioma. Kaijser has classified his seventy-four cases into four types with pathologic description and symptoms of each and is particularly interested in the phlebolith shadows frequently seen by *x*-ray as a diagnostic aid.

A typical long-standing case was reported by Pierose[6] in 1940. His patient, a woman of forty, had had spells of anemia associated with tarry stools for eleven years. At operation, three feet of small intestine were removed which showed diffuse telangiectatic cavernous hemangioma. She was reported well nine months later. An excellent review of the literature is added.

Christopher[7] found eleven cases reported since Kaijser's list which would make eighty-five up to 1942. His patient, a woman of twenty-six, had a long-standing anemia, 4 plus blood in the stool, a negative

x-ray. At operation a bright red coloration of both sides of the intestine down to the mesentery was found in the upper ileum.

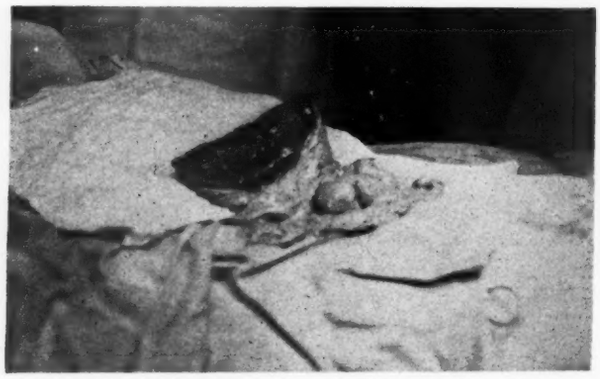

Fig. 1. Tumor delivered through abdominal incision before any clamps were applied.

Four inches of intestine were resected, microscopic diagnosis was congenital hemangioma of ileum with secondary ulceration and hemorrhage.

Hemangiomas of the intestine vary tremendously in type, distribution and course. The classification given by Kaijser[5] which is stated to be essentially that of Oberndorfer seems an excellent one for practical purposes. He divides these angiomas into 4 groups as follows:

1. *Multiple phlebectasia* consists of dark bluish-red nodules ranging in size from pinhead to pea which are scattered over a limited portion of the intestine. These are usually in the submucosa though they may be subserous and are usually opposite the mesentery. Each one is connected with one of the smaller veins and is made up of communicating cavities. These are probably not true tumors but may be the result of some back pressure although they are often given as examples of hemangioma of the intestinal tract. There are usually no clinical symptoms and very few have detectable hemorrhage in the canal. He lists twenty-seven cases.

2. *Cavernous hemangioma* is divided into those developing by diffuse permeation in the intestinal wall and into those growing more compactly, thus frequently becoming polypoid. These are the angiomas particularly prone to cause hemorrhage or obstruction. He lists thirty-two cases.

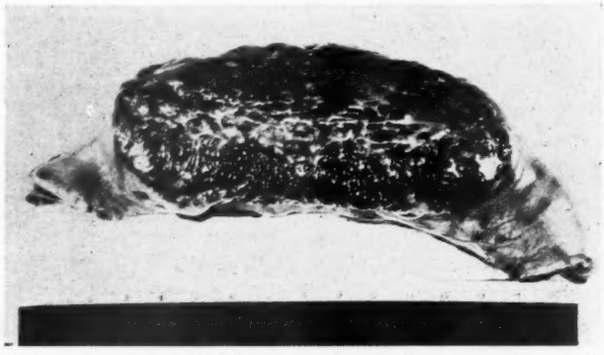

Fig. 2. Appearance of fresh specimen after removal; much of blood has run out.

3. *Simple hemangioma* or capillary hemangioma is a network of dilated capillaries as compared to the large blood filled, thinly lined communicating cavities of the cavernosa type. The simple type usually appears as a round submucous tumor, up to a plum in size, protruding into the canal

and covered by normal mucosa. Kaijser found seven cases.

4. *Angiomatosis* is his heading to cover the occurrence of multiple angiomas varying in structure from the usual cavernous type to one rich in cells and stroma, some even suggesting angiosarcoma. Those in the intestine may be tiny nodules or plaques of considerable size but do not infiltrate and are usually on the surface away from the mesentery. Seven cases are reported.

From the surgical viewpoint, the definite separation of blood-vessel tumors into classes is not of great value. It may simply be considered that hemangiomas are essentially endothelial tumors composed of capillaries or dilated blood spaces or any gradation between the two. The tumors may be highly vascular or consist mostly of masses of endothelial elements. Any combination of the solid or open vessel type may be seen. They may be single or multiple. When sometimes these tumors seem to spread, the cause is usually a simple hypertrophy of the vascular elements with-

Fig. 3.

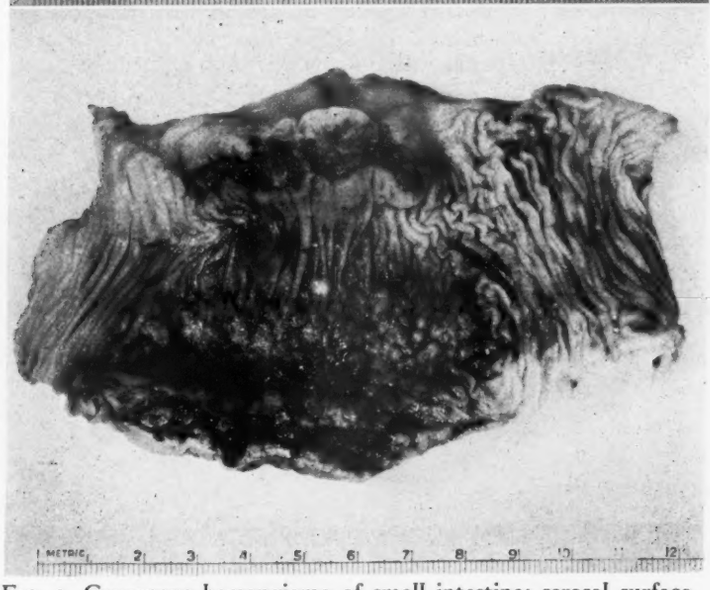

Fig. 4.

Fig. 3. Cavernous hemangioma of small intestine; serosal surface.
Fig. 4. Cavernous hemangioma of small intestine; mucosal surface.

out neoplastic overgrowth. Malignant angiomas are far more rare though there are reports of metastases especially after trauma or repeated recurrence.

Fig. 5. Cavernous hemangioma of small intestine; microphotograph showing extensive involvement of entire wall. × 18.

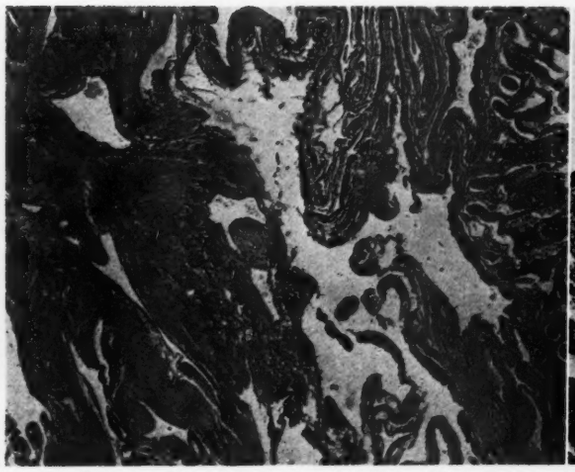

Fig. 6. Cavernous hemangioma of small intestine; microphotograph showing mucosal half. × 60.

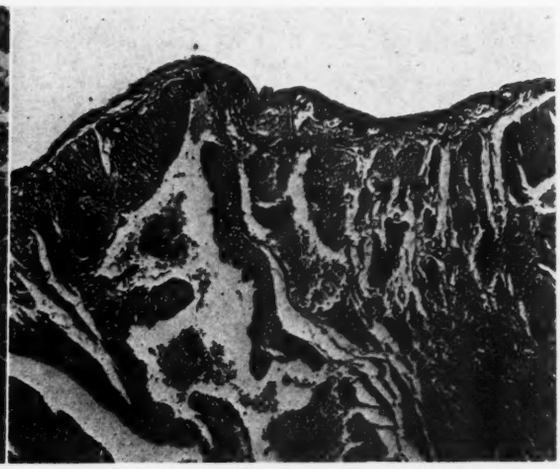

Fig. 7. Cavernous hemangioma of small intestine; microphotograph showing serosal half. × 60.

While many angiomas give no sign of their presence, others may show most alarming symptoms requiring immediate interference. The characteristic symptom is hemorrhage often beginning in infancy. The bleeding may be undetected and yet be accompanied by a true anemia of long standing even associated with asthenia and cachexia. In other cases hemorrhage is severe enough to cause death. Less frequent is obstruction which may be due to polypoid encroachment on the intestinal lumen, to an encircling mass with added edema or to intussusception. Acute obstruction seems more common than the chronic. A third symptom is due to acute inflammation of the tumor for which reason a diagnosis of appendicitis has been made in patients found to have instead angioma of the terminal ileum. In the report of McClure and Ellis,[4] for example, of twenty-four cases collected, there were symptoms in eighteen, hemorrhage in nine, acute

intestinal obstruction in four including one intussusception, chronic obstruction in three and acute inflammation in two.

Diagnosis before operating is rare. There are no diagnostic signs of certainty except in those tumors visible by endoscopy. Barium *x*-ray may in some reveal an intestinal tumor but does not suggest its nature. Kaijser[5] emphasizes repeatedly and noted in his own two cases the presence on the *x*-ray film of numerous rounded shadows of calcium density in the region later found to be the tumor site, these apparently being shadows of phleboliths within the angioma. This diagnostic sign he believes is usually confined to the cavernous type of hemangioma. In general, unexplained intestinal bleeding, in small or large amount, especially of long standing is the most typical sign and requires at least consideration of hemangioma as a diagnosis.

The danger of intestinal hemangioma depends largely on its type. Multiple phlebectasia seldom gives signs and is usually an incidental finding at autopsy or operation. In the other types there are many deaths from hemorrhage; all authors speak of the high mortality. In simple hemangioma an occasional death from hemorrhage has been reported; Kaijser[5] found one lethal hemorrhage in seven cases. The prognosis is much more grave in cavernous hemangioma. Some are too extensive for extirpation, in others acute hemorrhage or obstruction makes operation imperative at an unfavorable stage or death may occur without operation. Brown's[3] figures are not far from the average: twenty cases in which there were no symptoms in seven, while of the other thirteen, seven recovered and six died. In angiomatosis, in which multiple tumors involve too great an extent of bowel to permit resection, death from more or less constant hemorrhage is not too uncommon.

Nearly all of the cases successfully treated have been surgical resections. Cauterization or partial extirpation usually has given only temporary relief. *X*-ray has given improvement in some cases though local radiation as by the use of implanted radon seeds is seldom the practical procedure that it is on the body surfaces. The injection of a coagulating substance gave a brilliant result in Bancroft's[8] case but is probably not generally suitable. There may be more indication for injection than has been generally appreciated when one considers the success with this treatment in surface hemangiomas at the New York Memorial Hospital.[9] In those cases unsuitable for surgical removal, one may have to be content with some less complete attack or even with treatment of the anemia alone.

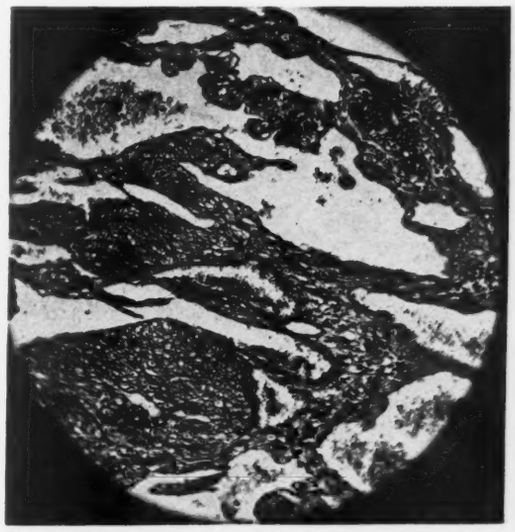

FIG. 8. Cavernous hemangioma of small intestine; microphotograph showing cavernous channels near mucosal surface. × 120.

CONCLUSIONS

1. A patient who had suffered from severe secondary anemia for years was found to have unsuspected intestinal bleeding. Resection of a portion of the ileum which included a cavernous hemangioma apparently cured her anemia.

2. A few typical reports from the literature show similar characteristic signs.

3. Few hemangiomas are malignant, most are congenital and grow by blood vessel hypertrophy. They vary from tiny symptomless nevi to large cavernous

masses. They may consist mostly of blood spaces or of the solid endothelial elements or of any combination.

4. Symptoms include hemorrhage, obstruction and those of acute inflammation. Typical diagnostic signs are lacking.

5. Surgical cure is usually possible and is the treatment of choice at a favorable stage. Benefits from radiation and from injection have been reported.

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Collections of pus deep in the cul-de-sac may be drained through the posterior vaginal wall. Patients must be selected carefully to avoid injury to the rectum or small intestine. Too vigorous or too extensive procedures may cause general peritonitis or an increase in the pelvic cellulitis.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

BENIGN GIANT CELL TUMOR OF THE PATELLA

CASE REPORT

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THERE are now twenty-one instances of benign giant cell tumor of the patella in the literature, including the present case. None of the cases previously reported are described at such an early stage in pathological development. Despite study in this early stage, the present case does little to clarify the etiological factors concerned in the growth of benign giant cell tumors.

FIG. 1. Benign giant cell tumor at superior pole of patella.

FIG. 2. Postoperative radiograph showing hemipatellectomy.

Embryologically, the patella goes through a well defined precartilaginous and cartilaginous phase in development. It has been the observation of Geschickter and Copeland that benign giant cell tumors occur exclusively in bones embryologically preformed from cartilage. These authors believe that this type of tumor is the result of trauma to cartilage bones. The traumatic incident injures periosteal blood vessels, and as a result there is impaired blood supply to an area of bone. Geschickter and Copeland consider the tumor as representing locally overstimulated osteoclastic activity which provides revascularization to this area of bone. They further point out that benign giant cell tumors form where the bone is spongy and relatively soft, such as in the proximal head of the tibia. Where there is mechanical resistance to growth of the tumor, such as in the heavy cortical bone in the shaft of the femur, the tumor remains quiescent as localized fibrocystic disease. The lining of the cysts in fibrocystic disease contains

many giant cells. Geschickter and Copeland's theory lends itself well to the findings in the patella where there is almost no

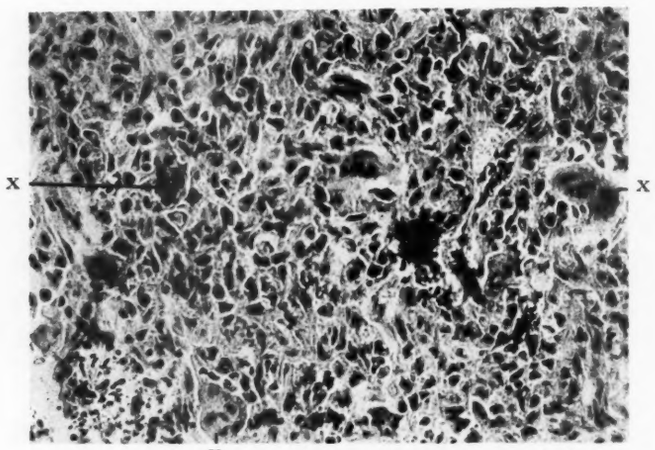

Fig. 3. Microphotograph of specimen, showing giant cells marked "x."

cortex and the bone is cancellous practically throughout.

Of the twenty cases of benign giant cell tumor already reported, at least three were cystic. History of trauma was recorded in the majority of cases, including the present one. This of course is of little significance, since the patella is so frequently injured in normal daily living. The alleged traumatic episodes occurred from several months to several years before the tumors were noticed, and often a year or so before the onset of the symptoms.

CASE REPORT

C. S., a white male shipyard worker, aged twenty-eight years, was admitted to the hospital on October 1, 1942. He complained of discomfort in the right knee cap. His past history was negative for bone or joint disease. On the industrial accident report the patient stated he had slipped on a steel plate and twisted his right knee a few days previously. After the question of workman's compensation arose, it was claimed that the initial trauma was a blow on the knee. On the other hand, the patient's aunt testified that he had complained of discomfort in the knee some months before the alleged accident.

X-rays were taken which revealed a cystic defect at the superior pole of the patella. (Fig. 1.) A preoperative diagnosis of benign giant cell tumor was made, and the tumor removed under general anesthesia by Dr. Ernest Burgess. The quadriceps tendon was split over the patella in longitudinal fashion, and the upper one-half of the patella was shelled out and turned on edge. The cartilage underlying the tumor was necrotic and yellow, and the tumor appeared to be almost at the stage of proliferation into the joint. An amputation saw was then used to divide the patella transversely in its mid-portion, and the tumor-bearing portion was excised. The quadriceps tendon was then resutured carefully with No. 1 chromic catgut, approximating it to the free raw margin at the site of patellar amputation. A long leg plaster cast was applied from the upper thigh to just above the ankle, with the knee in complete extension.

The postoperative course was uneventful, and the patient was able to return to work one month later. The cast was left on for three and one-half weeks. Slight effusion and quadriceps atrophy were noted five weeks postoperatively. Several months later the patient's recovery was complete. He was accepted by the Navy and is now in service.

Report of pathological examination by Dr. Thomas D. Robertson is as follows:

"Examination of the sections prepared by decalcification, and as seen under the microtessar lens shows bone trabeculae separated by fatty marrow. Towards the cortex the trabeculae become thicker and more compact. It is seen that down in the trabeculated portion

there is a well defined cellular zone which, however, is not surrounded by a capsule, with the cellular tissue extending out in the neighboring nucleus, while the other cell is a giant cell with many small nuclei like those in the other cells. These giant cells are scattered throughout. Ex-

Table I

Author	Year	Age	Sex	Diagnosis	Methods of Diagnosis	Recurrence	Etiology	Operation	Metastases
Wilks, Samuel	1842	24	F	Myeloid disease	Microscopic	.....	Trauma	Amputation	o
Cooper, Sir Astley	1895	..	..	Cystic endosteal myeloid sarcoma	Microscopic	.....	.....	.....	o‡
Jones, R	1895	20	F	Endosteal sarcoma	Microscopic	.....	Trauma	Amputation	o§
Horai	1896	39	F	Myeloid sarcoma	Microscopic	.....	Trauma	Amputation	o
Kudak, F	1907	25	M	Central giant cell sarcoma	Microscopic	.....	Trauma	Excision	o
Moranek, A	1907	30	M	Giant cell sarcoma	Microscopic	.....	Trauma	Excision, plastic	o
Wanach, R	1910	37	F	Primary sarcoma	Microscopic	.....	Trauma	Excision, plastic	o
Baldwin	1925	19	M	Giant cell tumor	Microscopic	.....	Trauma	Excision	o
Cole, W. H	1925	32	F	Osteitis fibrosa with giant cells	Microscopic	Once	Trauma	Curettement with phenol	o*
Faltin, R	1925	27	F	Giant cell tumor	Microscopic	.....	None	Curettement	o
Abadie, J	1928	45	F	Giant cell tumor	Microscopic	.....	.....	Excision	o
Abadie, J	1928	31	F	Giant cell tumor	Microscopic	.....	Trauma	Curettement, plastic	o
Giordano, G	1928	20	F	Giant cell tumor	Microscopic	.....	Trauma	Excision, plastic	o
King, M. J. and Towne, G. S	1929	19	M	Primary giant cell tumor	Microscopic	Once	Trauma	Curettement	o*
Indan, A	1930	35	F	Giant cell tumor	Microscopic	.....	Trauma	Excision, plastic	o
Kraft, E	1931	32	F	Giant cell tumor	Microscopic	.....	?	Curettement	o
Geschickter and Copeland	1931	31	F	Spindle cell variant	Microscopic	.....	Trauma	Curettement	o
Linde, S. A	1932	37	M	Giant cell tumor	Microscopic	.....	Trauma	Excision, plastic	o†
Dillehunt and Chuinard	1938	34	F	Giant cell tumor	Microscopic	.....	None	Excision, plastic	o
Levine, M. A	1943	31	M	Cystic benign giant cell tumor	Microscopic	.....	Trauma	Excision, plastic	o
Roemer, F. J	1943	20	M	Benign giant cell tumor	Microscopic	.....	?	Excision, plastic	o

* Note that in both cases of recurrence curette technic had been used.

† No. 1162—Registry of bone sarcoma of the American College of Surgeons.

‡ Hunterian Collection—Royal College of Surgeons No. 1637.

§ Hunterian Collection—Royal College of Surgeons No. 1637A. This case was published by D'Arcy Power. In review of his paper in the British Medical Journal, 1895, p. 419, mention is made of a sarcoma of the patella reported by Mr. Pepper.

trabeculae, but the area is somewhat spherical, quite well defined, with no trabeculae coursing through it.

"With the low power lens one can see an admixture of two main types of cells. One type is either polyhedral stellate or spindle shaped with single rather pale staining finely granular amined under the high power lens there are no mitotic figures and the cells do not have the large nucleoli of a malignant cell. There is nothing to suggest malignancy. Blood pigment is not noted.

"Pathological Diagnosis: Benign giant cell tumor of the patella."

Since out of 250 benign giant cell tumors reported by Geschickter and Copeland, there were thirty-one recurrences and three metastases, it would seem advisable to resect the entire lesion when working in areas where this can be done and still preserve function. In dealing with patellar tumors this plan is certainly preferable to the common practice of curetting out the tumor and cauterizing the tumor bed. In reviewing the series of patellar giant cell tumors it is seen that the only two cases of recurrence appeared after the curettement technic was carried out at the primary operation. Geschickter and Copeland, and William B. Coley point out that it is not always possible to differentiate malignant tumors from benign giant cell tumors even by means of complete *x*-ray and careful microscopic study. An excellent functioning knee is obtained by hemipatellectomy, and a good knee is obtainable with total excision of the patella. These two would seem to be the procedure of choice. The entire lesion and a margin of healthy tissue around it should be removed.

Changing terminology has led to some confusion. All the following terms have been used in the past to describe what we commonly know as benign giant cell tumor: Benign giant cell sarcoma, medullary giant cell sarcoma, primary sarcoma, giant cell sarcoma, giant cell tumor, primary giant cell tumor, endosteal myeloid sarcoma, myeloid disease, myeloid tumor, myeloid sarcoma, and osteoclastoma

It is obvious that osteitis fibrosa cystica in some stages is indistinguishable from benign giant cell tumors containing cysts, thus allowing some elasticity in diagnosis. Lesions reported by William B. Coley, M. A. Levine, and the case of Sir Astley Copper mentioned in a paper by D'Arcy Power were cystic. Geschickter and Copeland report a spindle cell variant of benign giant cell tumor in a thirty-one-year old white woman which was treated by curettage. The patient was well when last seen six years later.

CONCLUSIONS

1. A very early case of benign giant cell tumor of the patella is reported.
2. The average age of patients is 29.4 years.
3. The lesion predominates in females with a ratio of 13 to 7.
4. Optimum treatment requires resection of the patella, removing a margin of healthy tissue and reconstruction of the quadriceps mechanism.
5. The occurrence of benign giant cell tumors of the patella is compatible with the theory that these tumors occur exclusively in cancellous bone which embryologically was preformed of cartilage.

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CRUSHING OF PHRENIC NERVE AND MULTIPLE COSTOTOMIES

AIDS IN THE REPAIR OF A LARGE IRREDUCIBLE INCISIONAL HERNIA

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THE following case report describes two auxiliary procedures used in the repair of a large incisional hernia, namely, crushing of the phrenic nerve and multiple costotomies.

CASE REPORT

The patient was a man, fifty-five years of age. He stated that the hernia had been present since 1931 and that it followed a cholecystectomy with postoperative pulmonary complications. Severe coughing had resulted in a complete separation of all of the deep structures in the line of incision. Six months later an attempt was made to repair the hernia but again pulmonary complications with coughing ensued and the attempt was not successful. Two years after that another repair was attempted, this time with the aid of fascial transplants from the thigh, but this, too, had failed.

The hernia was an extremely large one, easily the size of a football, and was only partially held in place by a specially made belt. The hernial ring extended through the upper one-half of the right rectus muscle; it was about 5 inches long and 2½ inches wide; and its margins were rigid. Complete reduction was not possible. About two-thirds of the contents could be replaced in the abdomen but one-third remained in the hernial sac. Even the loss of ten pounds in weight by means of a reduction diet, did not aid in replacement. It was apparent that the usual methods of repair would not be successful and that some additional procedure or procedures would be necessary.

As the first step, the right phrenic nerve was crushed, under local anesthesia, in order to produce a rise in the right diaphragm and thereby increase the size of the abdominal cavity. The desired result was obtained. Immediately following this procedure it was possible to replace the hernial contents completely within the abdominal cavity. Fluoroscopy revealed an elevation of the right diaphragm of about two and one-half inches.

Two weeks later, under general anesthesia, repair of the hernia was undertaken. An incision was made over the central portion of the hernia, dissection was carried down to the hernial hiatus, and the peritoneal portion of the sac was removed. The sac consisted only of skin and peritoneum both of which were very thin. The posterior rectus sheath was then dissected free from the anterior sheath completely around the margins of the opening. These were very firm structures. The atrophic fibers of the rectus muscle lay between them. It was then found that only with considerable tension was it possible to approximate the fascial margins; in fact, the tension was so great that it appeared useless to attempt closure under the circumstances.

It had been noted that as a result of his weight loss, the costal arch flared on each side and the upper abdomen was scaphoid in shape. This fact suggested that the mobilization of the costal arch on the right might relieve the tension sufficiently to make it possible to approximate the fascial margins easily, and thus greatly aid in closing the hernial opening. Accordingly, the dissection was carried up over the lateral chest wall to the axillary line exposing the tenth to seventh ribs and the tenth, ninth, eighth, and seventh ribs were sectioned subperitoneally in an arc running medially upward. The costal cartilages of these ribs were severed at their attachments to the sternum. The lower part of the right costal arch was immediately mobilized by this procedure, with the desired results. It was then possible not only to approximate the structures forming the hernial margins but also to overlap them by about one and one-half inches.

The lateral side of the posterior rectus sheath was then sutured under the medial side of the posterior sheath with an overlapping of one

and one-half inches; the free margins of the medial posterior sheath were sutured to the top of the lateral posterior sheath; the lateral side of the anterior sheath was sutured over the anterior surface of the posterior sheath; and the remaining leaf of the anterior sheath was sutured over the anterior surface of the opposite anterior sheath. Continuous chromic catgut sutures were used in the first three closures and interrupted silk sutures in the fourth. A very firm closure was obtained. The skin was closed with clips and a drain was inserted through a stab wound.

The postoperative course was uneventful. No pulmonary complications developed, and, contrary to our expectations, the pain as a result of the rib fractures was not excessive.

An opportunity to observe the results of closure presented itself five weeks later when it was necessary to open the incision and remove the silk sutures because of superficial infection. The abdominal wall was firm throughout and the deep structures apparently were well healed.

SUMMARY

The repair of a large incisional hernia, which could not be accomplished by the usual methods, was made possible by two additional procedures, (1) crushing of the phrenic nerve, and (2) multiple costotomies.

1. Crushing of the phrenic nerve produced an elevation of the diaphragm which provided more room in the abdominal cavity and permitted reduction of the hernia. This procedure may have an additional advantage in selected cases because it removes the muscular action of the diaphragm on the affected side in the event of such postoperative complications as vomiting, coughing, etc.

2. Multiple costotomies on the affected side were a definite factor in the successful repair of the hernia since they resulted in mobilization of the costal arch so that the hernial margins could be overlapped without tension.

New Instruments

A SIMPLE SKIN GRAFT KNIFE FOR GENERAL USE*

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DURING recent years, a multitude of devices, machines and other contraptions for cutting skin grafts have been introduced by surgeons and surgical supply houses. Nearly all of them require the application of a cement or other substance to the skin and in many cases, this makes the graft difficult to handle, particularly when only small grafts are needed.

There have been two reasons for the introduction of such a collection of devices: (1) The value of early skin grafting of burns and other surface defects has been irrefutably established, and so there has been a great demand for grafts, especially of the split-thickness type described by Blair and Brown.[1] (2) It is wrongly assumed that the average surgeon cannot cut a thick-split graft by a free-hand technic. Some utopian device has been sought whereby the needed graft can be obtained without hacking-up and morcellating donor sites to the extent that sometimes a donor defect is created which is worse than the recipient site.

Most surgeons have tried to cut a free-hand graft from time to time and, having met with indifferent success, have turned to expensive and complicated devices or have referred even simple cases to the plastic and reconstruction surgeon. While the latter is admittedly most desirable, there are a great many cases, particularly with the current shortage of skilled physicians and surgeons, wherein crippling deformity could be prevented by early grafting by the general surgeon, provided he is willing to spend the time and pains necessary to prepare the recipient site and give proper after-care.

AUTHOR'S INSTRUMENT

The one instrument with which the general surgeon has had the most success in cutting grafts is an old-fashioned straight razor. If the razor is *sharp*, nearly anyone can cut a graft by the free-hand technic with fair success. There are two difficulties, however, which are frequently encountered. The razor is clumsy to hold and secondly, it is rarely sharp enough.

To obviate these difficulties a skin-graft knife has been constructed which consists of an inexpensive and rigid handle and removable "straight razor" single-edge blades* which can be purchased in packages of five for a few cents at the corner drug store. (Fig. 1.) Such a knife is a remarkably successful instrument. (Fig. 3.) No suction box nor other apparatus is necessary.

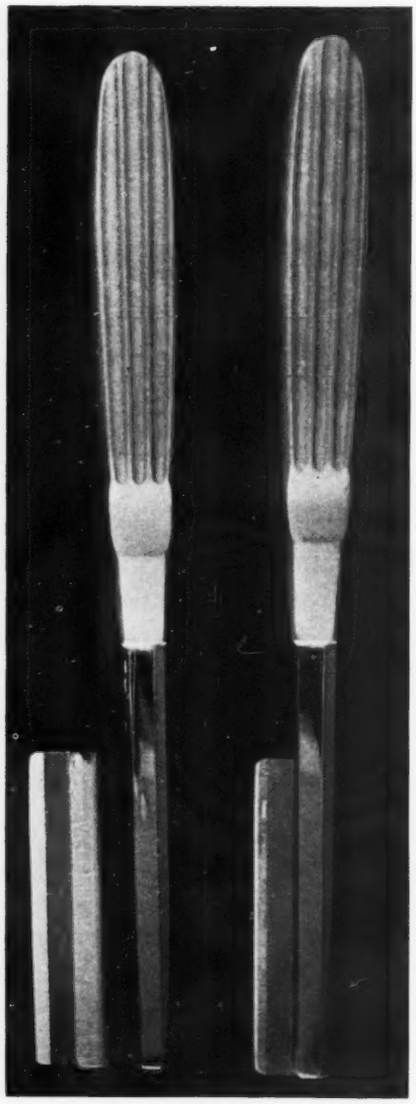
METHOD OF CUTTING GRAFTS

The methods of preparing the recipient area are well publicized and are beyond the scope of this paper. It does seem

*Weck & Co., Brooklyn, N. Y. 'Sextoblade'.

* From the Division of Plastic and Reconstruction Surgery, Department of Surgery, National Naval Medical Center, Bethesda, Md. The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or as reflecting the views of the Navy Department or the Naval Service at large.

appropriate, however, to mention in some detail the exact method of cutting a graft by the free-hand technic.



A B

FIG. 1. The author's skin-graft knife. A, assembled; B, with removable blade (Weck & Co. "sextoblade") detached.

A donor site is selected (usually the thigh for men and the buttock for women) and prepared by cleansing with green soap, removing the soap with ether and painting with tincture of iodine (3½ per cent). The skin is then covered very lightly with a thin film of petrolatum and the excess scraped off with the edge of a sterile tongue depressor.

The operator stands so as to be able to cut a graft from right to left, if he is right-handed or left to right if he is left-handed. His assistant stands on the same side as the operator and either above or below him depending upon whether the graft is being cut up or down the leg. It is the duty of the assistant to give countertraction by means of a flat surface such as a tongue depressor wound with gauze so that it will not slip. (Figs. 2 and 3.)

The operator holds in his left hand a straight edge of some type, the most readily available of which is a sterile tongue depressor. (Figs. 2 and 3.) The assistant has in his free hand a pair of forceps with which to steady the graft as it comes over the back of the knife. The nurse holds a sponge wet with normal saline and drips a few drops on the blade should they be required to moisten and lubricate the knife.

With a good light on the field, the operator begins a longitudinal "to and fro" motion with the blade, steadying the skin with the tongue depressor in his left hand. The knife, which in the case of the author's instrument will be absolutely fresh and sharp, will sink into the skin to the required depth. Then, seemingly without any conscious effort of pushing the knife forward, the blade travels into the skin and parallel to the skin surface. Emphasis should be placed on avoiding any forward push of the knife. With the tongue depressor in the left hand keeping just ahead of the blade, the graft is cut, keeping the knife at that distance from the surface where the blade looks slightly blue beneath the severed graft.

In this way, with close attention to detail, grafts of uniform thickness and width can be cut to almost any desired length. (Fig. 3.) Their width, however, is limited to about two and one-half inches. If wider grafts are desired, the standard Blair knife, the Ferris Smith modification of the Blair knife, or the dermatome should be used. Even small grafts laid side-to-side can cover a huge surface area and

the resulting growing skin will serve all functions for which thick-split grafts are intended.

hand technic because there is provided an extremely sharp blade and a convenient handle. Only a little practice is necessary

Fig. 2. The position of operator and assistant as graft-cutting operation is begun.

Fig. 3. Graft being removed. Note uniform thickness, even edges and simplicity with which graft is cut. The graft is retracted as it lies on the bed from which it was removed, but yields a full two-inch width with ease.

SUMMARY

A simple, inexpensive skin graft knife is presented which utilizes two and one-fourth inch removable packaged razor blades. The knife can be used easily by even inexperienced operators to cut Thiersch or thick-split grafts by the free to acquire facility which will give the general surgeon a ready source of skin grafts for a multitude of purposes.

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A RETRACTOR

DESIGNED TO FACILITATE EXPOSURE IN OPERATIONS ON THE SPINAL COLUMN AND OTHER DEEP STRUCTURES

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A RETRACTOR which will grasp and hold tissues deep in wounds during operations, especially during those on the spinal column, has been difficult to obtain. Many of the retractors available have smooth or rounded edges, which slip over the deep structures which are to be retracted. Furthermore, many of the handles of such instruments are poorly shaped and of insufficient size which makes it difficult for the assisting surgeon to maintain them in correct position without discomfort or shifting hands from time to time. With movement of the retractor the soft tissues slip away from it and thus obstruct the surgeon's view. The surgeon and assistant are needlessly annoyed and operations are prolonged, since even the most capable assistant finds it impossible to maintain adequate exposure with an improper retractor.

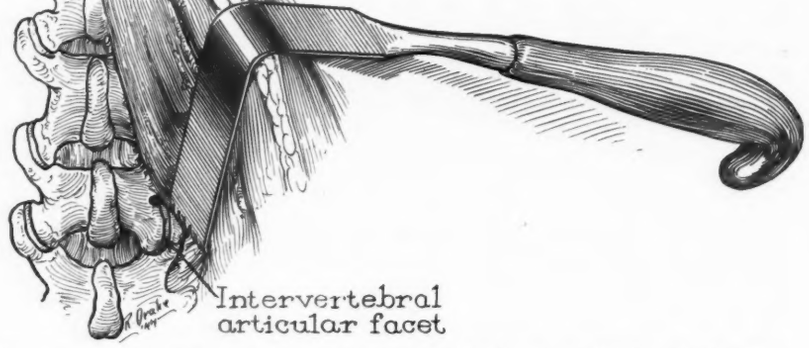

FIG. 1. Retractor in position and exposing the intervertebral articular facet.

After trying many types of instruments, I designed the retractor herein described, which in the hands of my associates as well as in mine has proved to be far more satisfactory than any instrument that has been employed heretofore. It has become a standard instrument employed during fusion operations on the spinal column, operations for intervertebral disks and in other deep surgical wounds.

This retractor is 8⅜ inches (21.3 cm.) in length with a blade 3 inches (7.6 cm.) long, 1 inch (2.5 cm.) wide and 1/16 inch (0.16 cm.) in thickness. It is bent into an acute angle of 72 degrees; the tip is notched with teeth that are angulated about 60 degrees and fairly sharp, so that once they are inserted into fibrous tissue the retractor remains in position. It is sufficiently strong so that considerable pull can be placed on it without bending it. The end of the handle is 4½ inches (11.4 cm.) in length and oval on cross section; it becomes increasingly thicker as it reaches the end thus permitting a firm grasp without discomfort. The extreme end forms a hook which rests against the little finger and prevents slipping. Such a retractor may be held for prolonged periods without discomfort; and as it gently pulls and forces outward, it maintains its hold on the fibrous structures.

I employ several of these retractors of varying depth and width. (Fig. 1.)

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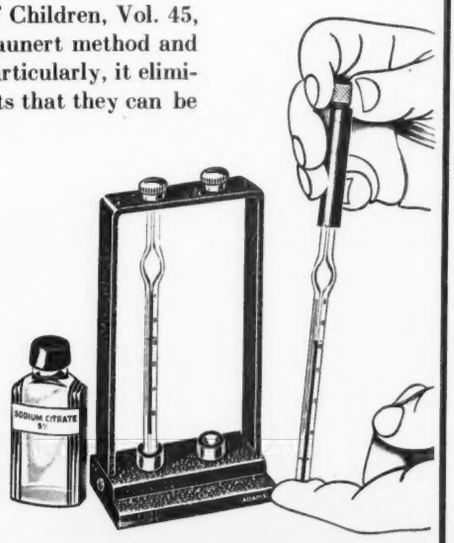

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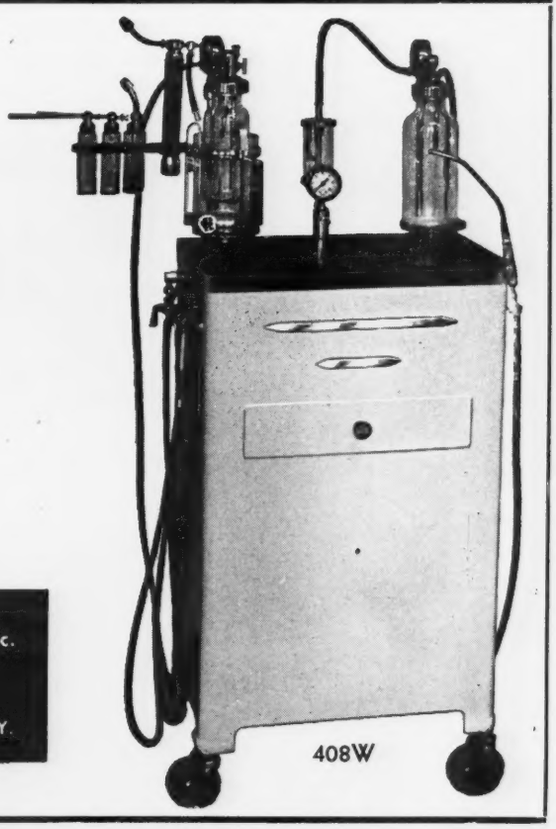

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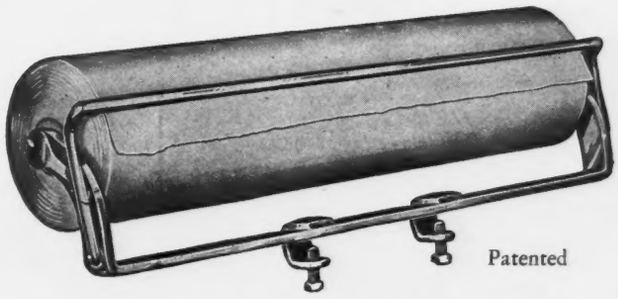

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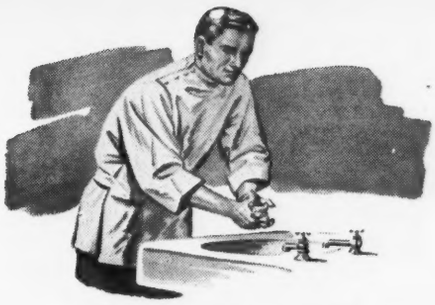

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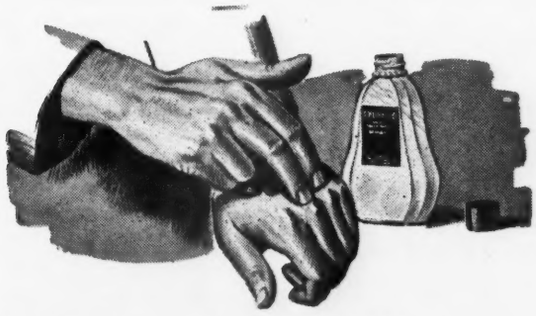

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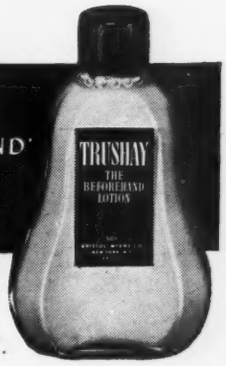

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Pyridoxine hydrochloride (B_6)	0.5 mg.
Calcium pantothenate	1 mg.

Plus all other factors naturally occurring in yeast concentrate. Noviplex is supplied in bottles of 100, 500 and 1000 capsules.

THE S. E. MASSENGILL COMPANY
Bristol, Tenn.-Va.

NEW YORK • SAN FRANCISCO • KANSAS CITY SE MASSENGILL CO

In the Management of Arthritic Patients

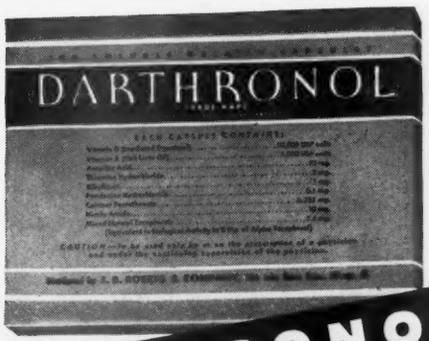
"VITAMINS IN ABUNDANCE SHOULD BE PROVIDED"

In the 1943 edition of Nutrition and Diet in Health and Disease, McLester emphasizes the importance of large amounts of all the essential vitamins in the treatment of chronic rheumatoid arthritis. He states that "Vitamins in abundance should be provided."

MOST rheumatologists have long recognized this need for all the vitamins—in addition to any specific requirement—in the management of the arthritides. The reports of many clinical investigations have emphasized the systemic nature of chronic arthritis and have revealed that best results were obtained when in addition to massive doses of vitamin D the other vitamins were administered simultaneously.

For the convenience of the physician in prescribing all these vitamins, and to assure greater patient cooperation, Darthronol supplies in a single capsule adequate amounts of all the known essential vitamins in addition to 50,000 U.S.P. units of vitamin D.

J. B. ROERIG & COMPANY
536 Lake Shore Drive • Chicago 11, Illinois



Each Capsule Contains:

Vitamin D (Irradiated Ergosterol)	50,000 U.S.P. Units
Vitamin A	5,000 U.S.P. Units
Ascorbic Acid	50 mg.
Thiamine Hydrochloride	2 mg.
Riboflavin	1 mg.
Pyridoxine Hydrochloride	0.1 mg.
Calcium Pantothenate	0.333 mg.
Niacinamide	10 mg.
Mixed Natural Tocopherols	3.4 mg.

DARTHRONOL *for the Arthritic*
a **ROERIG** *Preparation*

Originally Introduced as DARTHRON

Coming!

Healing Rate of Human Skin T. CUNLIFFE BARNES, Philadelphia

Non-splinting Treatment of Elbow Joint Injuries
THOMAS A. BOUTROUS, ALEXANDER BAIN and W. A. CHIPMAN, Baltimore, Md.

Working Basis for the Treatment of Head Injuries
THEODORE L. HYDE, The Dalles, Ore.

Treatment of Abdominal Injuries
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Ethyl Alcohol Intravenously as Post-operative Sedative R. J. BEHAN, Pittsburgh

Use and Abuse of Cesarean Section EDWARD G. WATERS, Jersey City

New Technic for Treatment of Acute Infections of the Colon
H. D. MEEKER, New York

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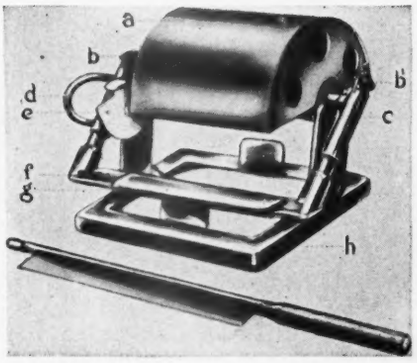
RALPH U. WHIPPLE, Elkins, W. Va.

THE LEADING INDEPENDENT SURGICAL JOURNAL

PADGETT-HOOD DERMATOME



By means of this unique instrument a sheet of skin of uniform thickness may be cut at any predetermined level the size of the drum (4 x 8 inches) from any area of the body. Those who have used the dermatome state that it simplifies the technique and enlarges considerably the whole field of skin grafting. Same blade used for drum may be placed in handle and used to cut razor grafts or for honing blade. Rubber cement for the drum and donor area also is available, as well as a knife sharpening service.

Manufactured and sold by

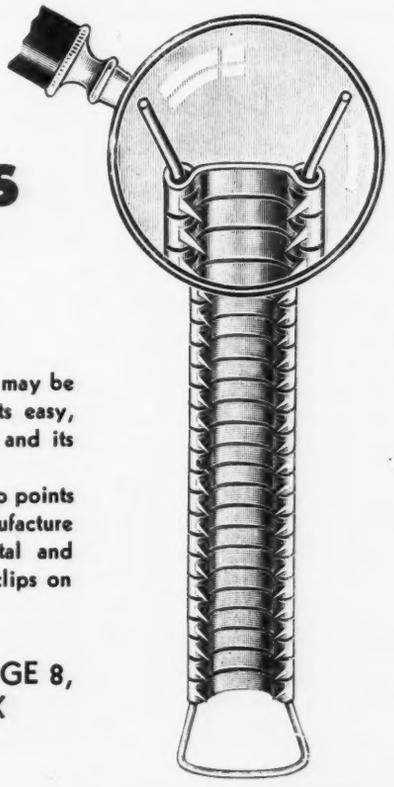
The Kansas City Assemblage Company

609 EAST 17th ST., KANSAS CITY 8, MO.

Deknatel Wound Clips

(MICHEL TYPE)

A Deknatel Product



The Michel type of wound clip is so widely used that it may be termed almost standard with surgeons. It is liked for its easy, rapid closing of skin wounds; easy, painless removal; and its dependability and economy in use.

The Deknatel Wound Clip is nickel silver, has very sharp points and is of the same high quality and reliability in manufacture that characterizes other Deknatel products for Hospital and Surgical use. Supplied in sizes 11 to 22 mm . . . 25 clips on wire holder for convenient sterilization and use.

DEKNATEL QUEENS VILLAGE 8, NEW YORK

Accepted...

AND SO WELL TOLERATED

Recent studies of the metabolic changes which occur during and immediately after surgical manipulation have demonstrated a sharp increase in the requirements for many nutrients. Protein, carbohydrate, and B vitamin needs rise abruptly, due presumably to the trauma of anesthesia and manipulation, and to the demands occasioned by the healing process. Out of these facts arises the dictum of early feeding of indicated nutrients in adequate amounts to prevent metabolic deficits and to encourage recovery at maximal rate.

Its balanced composition makes Ovaltine (made with milk according to directions) a valuable component of the postoperative and convalescent diets. Delicious in taste, it is taken readily and enjoyed by all patients. Its low curd tension makes for rapid gastric emptying, accounting for its remarkable tolerability. Furthermore, this delightful food drink provides the nutrients most urgently needed: biologically adequate protein, readily utilized carbohydrate, highly emulsified fat, essential B complex vitamins, and minerals.

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Three daily servings of Ovaltine, each made of ½ oz. Ovaltine and 8 oz. of whole milk,* provide:

PROTEIN	31.2 Gm.	VITAMIN A	2953 I.U.
CARBOHYDRATE	62.43 Gm.	VITAMIN D	480 I.U.
FAT	29.34 Gm.	THIAMINE	1.296 mg.
CALCIUM	1.104 Gm.	RIBOFLAVIN	1.278 mg.
PHOSPHORUS	.903 Gm.	NIACIN	7.0 mg.
IRON	11.94 mg.	COPPER	.5 mg.

*Based on average reported values for milk.

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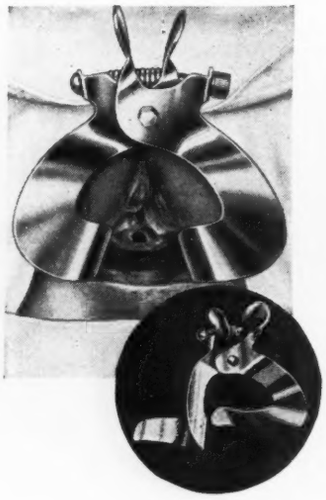

The newest, most valuable aid to the physician practicing obstetrics! The Radcliff Perineal Retractor enables the attending physician to perform perfect perineorrhaphy. It is inserted in the same manner and with the same ease as a Graves speculum, yet it gives full exposure for repair. The retractor is always above the field; no visual interference, no projections to entangle sutures. An adjustment for tension is provided but is seldom needed, as this retractor fits most patients without variation. Made of stainless steel, thin, flat, pliable.

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Mercurochrome

(H. W. & D. brand of merbromin, dibromoxymercurifluorescein-sodium)

is economical because stock solutions may be dispensed quickly and at low cost. Stock solutions keep indefinitely. Mercurochrome is antiseptic and relatively non-irritating and non-toxic in wounds.

Complete literature will be furnished on request.

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Zephiran Chloride is a germicide of high bactericidal and bacteriostatic potency. In proper dilutions it is nonirritating and relatively nontoxic to tissue cells.

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Zephiran Chloride is widely employed for skin and mucous membrane antisepsis—for preoperative disinfection of skin, denuded skin and mucous membranes, for vaginal instillation and irrigation, for vesical and urethral irrigation, for wet dressings, for irrigation in eye, ear, nose and throat infections, etc.

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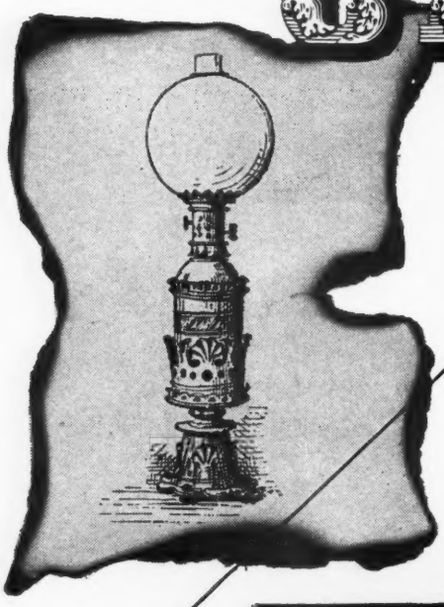
something **OLD**



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As devoid of the glamor of newness . . . and as classic as the doctor's blue serge suit, 'Urotropin'* urinary antiseptic has weathered many a season, bringing comforting satisfaction to its users. This distinguished, original brand of methenamine remains today a preferred urinary antiseptic for the treatment of pyelitis, pyelonephritis, cystitis and other uncomplicated urinary tract infections; and not infrequently, it has provided effective action where other, and newer treatment proved disappointing.

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5-grain tablets Boxes of 30	7.5-grain tablets Boxes of 20	Also in bottles of 50, 100, 500 and 1000 tablets	'Urotropin' Urinary Antiseptic (crystals). Bottles of 1 ounce, ¼, ½ and one pound

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8 hours — when most needed

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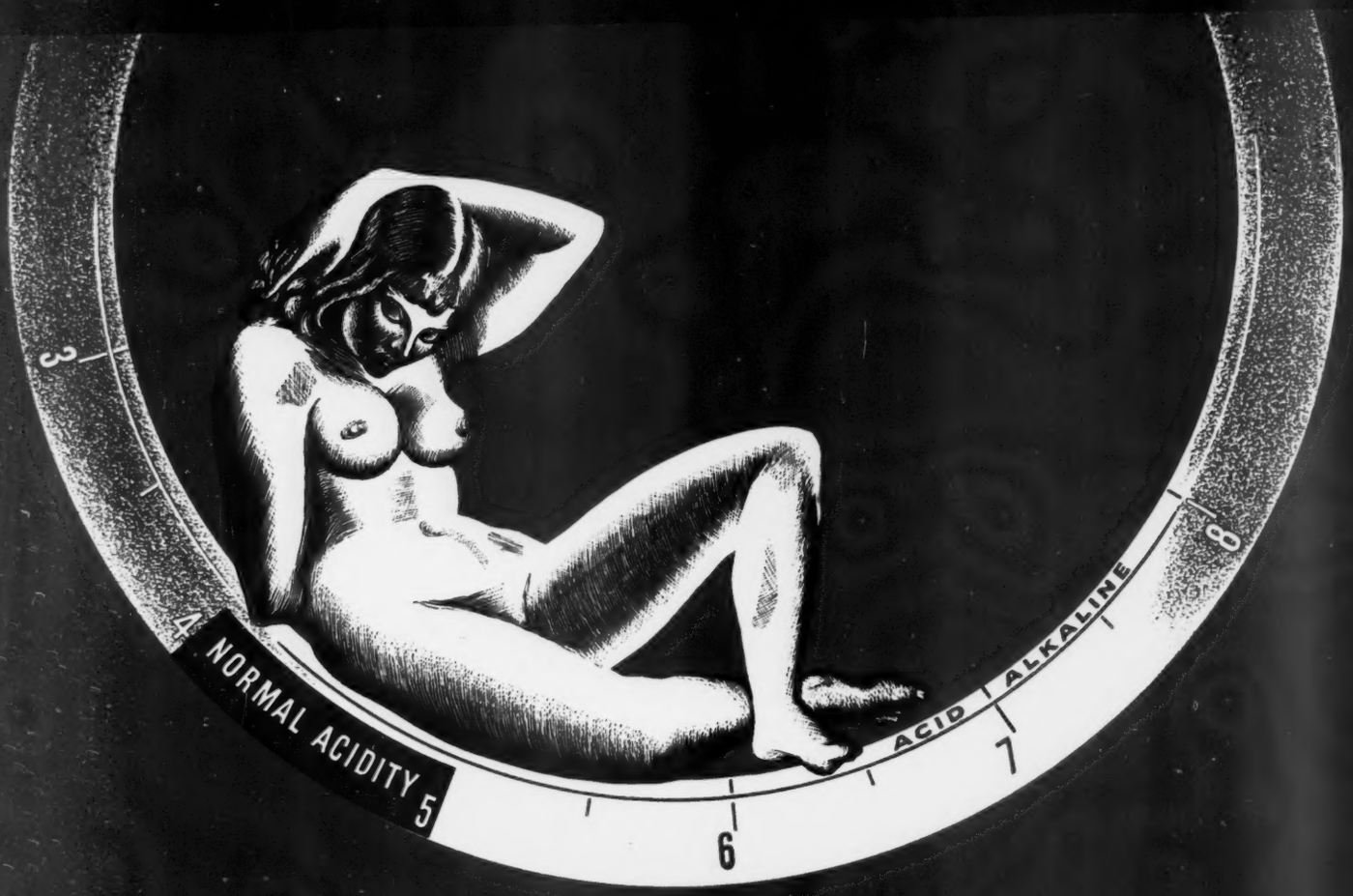

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A PRACTICAL NEW APPROACH THROUGH RESTORATION OF NORMAL ACIDITY

Investigators have shown that vaginal inflammation tends to interfere with glycogen metabolism in the epithelial wall . . . resulting in lowered acidity or even alkalinity (a condition favorable to the infection). Numerous controlled clinical studies* have demonstrated that proper acidification of the vaginal vault is often the *simplest and most direct form of effective therapy.*

Aci-jel, a bland, water-dispersible, buffered, acid jelly provides a simple, yet highly effective treatment of non-specific vaginitis, trichomoniasis, monilia vulvovaginitis, certain types of cervicitis, and following cervical cauterization or cauterization. The usual dosage is 5 cc. (applicator full) intravaginally before retiring and repeated in the morning, followed 8 hours later with a cleansing douche. Aci-jel (available in 3¼ oz. tubes with or without measured applicator) invites a rigorous clinical trial in your own practice.

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